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COLLECTION
For the IMPROVEMENT of
Husbandry and Trade.

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may be made Navigable; of WEIGHTS and MEASURES, of
WOODS, CORDAGE, and METALS; of BUILDING and STOWAGE,
the Vegetation of PLANTS, &c. with many other useful Par-
ticulars, communicated by several eminent Members of the
ROYAL SOCIETY, to the COLLECTOR,

JOHN HOUGHTON, F. R. S.

Now Revised, Corrected, and Published,
With a PREFACE and useful INDEXES,
By **RICHARD BRADLEY, F. R. S.**
and Professor of BOTANY in the University of *Cambridge*.

V O L. II.

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A
COLLECTION

For Improvement of
Husbandry *and* Trade.

FRIDAY, January 3. 169 $\frac{5}{8}$. NUM. CLXXIX.

From the Streights came to London in the year 1694. twenty one ships. We make better glass than Venice. The case of the countries in the Streights. A proposal. Twenty one ships came from Dantzick, Anno 1694. From Holstein sixteen. From Ireland eight. How trade and seamen may be encreased between England and Ireland. The act against importing Irish cattle vindicated.

THE next place to *Scotland*, from whence came the most ships to *London* in the year 1694. was the *Streights*; and from thence came twenty one, truly a very small number; but the war I take to be the cause, and the

2 A COLLECTION for Improvement

French were very potent, although the goods from thence are *silk* and others, that are very valuable, and we used to have more glasses, before our industry and diligence taught us to make them better and cheaper than the *Venetian*.

As we could not trade in these seas with *France*, neither could we much with the *Savoyard*, his country being much harass'd. To *Venice* and the rest of *Italy*, we had some, but that year in our trade to *Turkey* we were unfortunate, *Palestine* is almost waste, and the kingdoms of *Algiers*, *Tunis* and *Tripoli* encourage not much merchandize; but without doubt, were there with every ambassador or consul a cunning man to pry into, learn and write all the histories of their trading, a greater advantage may be gathered from it than ever yet the glass amounted to; but 'tis time and necessity must bring these things to pass.

From *Dantzick* came as many ships as from the *Streights*, viz. twenty one; and truly from that one place, 'tis a good store: for tho' 'tis the only port I can understand belongs to *Poland*, yet the *Poles* being generally in war, and most of them, either gentlemen or slaves, I think much is not to be expected from them; they are commonly differing among themselves, and I am afraid will hardly be much better, till their Kings have greater or less power.

From *Holstein* came but sixteen ships, and in them brought *deals*, *tar*, *corn*, and some few odd things; and how to mend the trade there, as yet I believe is somewhat difficult.

From *Ireland* came to *London* but eight, which is no argument of their trade; because the shore from *Bristol* to *Scotland* lies much more convenient

of HUSBANDRY and TRADE. 3

nient for their correspondency. I wish the commerce with them was far more great, and I doubt not but it may be made so by a discouragement of their wood upon the western coast; for then we must supply with coals, and that will make great intercourse. *Whitehaven* and *Morson* have found the benefit already, and I see not why those two shores may not make as great a nursery for seamen as the trade between *Newcastle* and *London*.

I know 'twill be expected I should say something about the *Irish* cattle, but of that in the first volume of my collection of letters for *Improvement of Husbandry and Trade*, Numb. 9. *October the nineteenth, 1682*. I have discoursed at large, proving the prohibition good for *England*, and answering all the objections I could meet with, and they were made by Sir *William Petty*, Mr. *Garway* the Parliament man, Mr. *John Collins* and others, and they were so industrious in it, that I believe they brought all the material objections could be made: for I find none since worth minding, and 'tis plain our people find so great an advantage, that even the talk of repealing that act is no ways heard.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, *January 10.* 169 $\frac{1}{2}$. NUM. CLXXX

In the year 1694. came to London from Guernsey and Jersey eight ships. These islands ought to be as well cultivated as Barbadoes. From France came seven ships, and in Anno 1668. came to London from thence to the value of one million two hundred thousand pound sterling. And Mr. Fortrey says, that a little before came to the value of two million six hundred thousand pound sterling. A proposal. There came from India four ships: and last year to Holland, fifteen or sixteen. The Dutch thrive by undisturbed joint-stocks, and by disturbance of ours we grow poor. The three ways for trading.

FROM Guernsey and Jersey came in the year 1694. to London eight ships. They being but little places it seems well, and I question whether so many came in time of peace: for 'tis probable enough that *French* goods may come in by their means at leastwise such as are prize goods: for I find by the *Gazettes*, they take from the *French* a great many vessels: but were these islands as well minded as *Barbadoes*, without doubt they might be made much more beneficial.

From

of HUSBANDRY and TRADE. 5

From *France* were brought to *London*, three ships and four prizes; tho' we take a great many, yet few come to *London*, occasioned by the war, and when peace will be restored, God knows; but the trade formerly used to be very great: for in the year 1688. several merchants examined it from the Custom-house Books of *London*, and found there came thither that year to the value of one million two hundred thousand pound sterling; and Mr. *Fortrey* before that gave an account that from *France* was exported to *England* to the value of two millions six hundred thousand pound, but what number of ships they came in, I have no account. Whether this would be a profitable trade to us or no, 'tis not proper for me at this time to determine: but the *English* were so pleas'd with their wines, brandies, and several other things, that divers wish for a restauration of that trade; but seeing that is not thought convenient, were I worthy to advise, I would have an account of all that were wont to be imported from thence, and if possible, procure the like in *England*, or some other of its plantations.

In the year 1694. came from *India* to *London* four ships, but what proportion that bears to the trade of our neighbours, I know not; but to *Holland* this last year came fifteen or sixteen; but whether considering their spice, &c. they are richer in proportion than ours, others know better than I.

I cannot but commend them for their industry, but that must something reproach us for being behind-hand. They are a settled undisturbed company; and we see they greatly thrive. We had a company did thrive also, but they have been disturbed with interlopers, and every

6 *A COLLECTION for Improvement*

session of Parliament have been in question whether they should continue or no, which have so harrassed and discouraged them, that the meanwhile, the bone is almost lost. I wish the matter were determined, and my sentiments of trade are as follows.

If we trade to countries able to *defend* us, and that are governed by *stated* laws, as *Spain, France, Holland*, and such like, I think an open *trade* best; but where the governments are able to *defend* us, and the rule is *arbitrary* as in *Turkey* and *Russia*, I am for a *regulated* company: for they must raise money for presents and several other occasions; but where they are *absolute, diverse, independent*, and not able to defend us, and we have *principalities* of our own, I see no way to manage but by a joint-stock; and my reasons therefore expect next *Friday* from

Yours &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, *January* 17. 169 $\frac{1}{2}$. NUM. CLXXXI.

The ill trading to India out of a joint-stock, and the conveniencies of trading in a joint-stock. No reason that a joint-stock by growing rich, should lessen trade.

LAST week I promised to give my reasons for trading in joint-stocks; to countries where

of HUSBANDRY and TRADE. 7

where we have some *principalities*, and neighbours that are *absolute, diverse, independent* and *unable* to defend us, and such are *India* and *Guinea*.

I would fain know whether any can shew a likelihood that if the trade had been every where open in *India*, the *Dutch* could have made the advantages they have done of their *spice-islands*, or if they had kept them in a regulated company, they can raise money by laying *mulets* on *merchandize*, when by reason of disturbances at home, they can send no goods out: would not the securing their *own* country at home be of more value than the preserving such trade at a distance; nay, if there should be any disturbance in those places, will not every man be more for securing his *private* estate than running any hazard for the *publick* good. May not any other *potent, wealthy* state, worm them out of those *countries*, or *princes* favours.

But *joint-stocks* may make great *colonies*, and have usually countries of their own to improve at pleasure, they have *ships* to offend or defend, they can spend every farthing of the stock they have, and gain credit for great sums more, they can make *alliances*, which may help at extremities, and surely no prince or potentate can be better friends than to have the government in their own hands. A *joint-company* can spend great sums to get new trade, or ingross commodities, and to think that when they are rich they will not strive to encrease the trade, is greatly preposterous. Who are more greedy of getting wealth, than those who have much already? Is it to be thought, that if an *East-India* merchant should gain twenty thousand pound, and be made a Knight, that he will not be then much more

8 *A COLLECTION for Improvement*

desirous to gain one hundred thousand pound, that he might be a Lord? Where do we see any Princes contend so much for more, as where they are great already? How comes the old proverb to be out of date, *crescit amor nummi, quantum ipsa pecunia crescit*? No, no, there are few men of such tempers. I doubt not, but if the *Dutch* have one hundred ships in *India*, they'll strive to make them two hundred, and if they get one country, they'll endeavour to gain another, to be its *barrier*; and the contrary is hardly any where found.

When I can see good answers to these reasons, I may change my mind; but till then, I shall heartily wish right understandings among our selves, lest ill betide us; and while we quarrel, the enemy eat us up.

Yours, &c.

JOHN HOUGHTON, F. R. S.



FRIDAY, *January 24.* 169 $\frac{1}{2}$. NUM. CLXXXII.

In 1694. came from Russia four ships. What commodities we bring thence. From Guinea came three ships. A probability of a greater trade to Guinea, and why. Commodities of Guinea. 'Tis a brave country. The case of an open trade, on sea or on shore.

FROM *Russia* came to *London* in the year 1694. but four ships. I have heard that by way of *Nerva* in the *Baltick-sea* come more: however the whole trade from so great a territory is but small, and I am informed that some of our neighbours make more of it. I am sorry that any should out-do us, and were it my proper business, I doubt not but to find a way to have it mended: the commodities we bring from thence, are *agarick, wood, pot-ash, bristles, feathers, stock-fish, sturgeon, caveare and isinglass, hemp, hides, honey, matts, seal-oil, linen and linen-yarn and furs*. Would we fill our country fuller and spend more of their product, we should then fetch more, and would we make our navigation cheap, we might then serve many others; but now there being a Committee appointed for the improvement of trade, perhaps these things may be farther enquired into.

From *Guinea* came to *London* in the year 1694. three ships, and how many went from thence to our plantations, I've at present no account of; it's probable the company's ships, and *inter-lopers*

10 *A COLLECTION for Improvement*

lopers might make a great number; but considering the country is very large and the coast long (I think seven degrees) methinks more than three ships might be freighted in a year to come home directly, and more commodities than *elephants-teeth*, *red-wood*, *bees-wax* and *gum animi*, might be found there. Are the *bones* and *skins* of oxen useful to a great many purposes, and those of *elephants* good for nothing? Will a *country*, that feeds so many myriads of people, supply us with no skins, other materials for dying or manufactures, nor *fruits*, nor *flowers*, nor materials for *food*, *physick* or *rayment*? 'tis very strange, tho' too true. I am told 'tis a delicate country, and thro' good management might yield most things can be expected from hot countries; what's the reason then we make no more of it? Truly perhaps 'tis because we are like the silly woman mentioned in the gospel: we are always learning but never able to come to the knowledge of the truth. How long have we been debating, and yet can't tell which is best, to trade thither in a *joint-stock*, a *regulated company*, or *open-trade*.

I'll endeavour to set them all in a true light, and hope we shall e're long come to a steady resolution.

I'll begin with the *open-trade*, and suppose we having no strengths there should trade every one for himself, as free as we use to do to *Holland*, *France*, and *Spain*. Would not the consequence be, that any other country might trade as free as we, and so the *Dutch* and *Spaniard* be served with more variety.

In the next place, we must trade with the natives either at *sea* or on the *shore*. If at *sea*, shall we not always have our trade to seek? For



of HUSBANDRY and TRADE. II

although the *Blacks* will go on board to barter, yet when they have sold their goods or slaves to one ship, they are not always provided for another; and then the ship must run farther, till new customers can be found at great uncertainties, which will force several to sell at very low rates, rather than stay there long for a market, and when great ships come, will not they be apt by *temptations, insinuations, or foul play* to prejudice the weaker? The *epitome* of this may easily be seen at *Ebisham* in *Surrey*; in time of drinking waters, the country fellows and girls come in with provision, and if there comes plenty of citizens and but few with victuals, the citizens pay sauce: but if the contrary, the provisions are sold to the standing house-keepers for half their worth, and thank them too, and the farmers are most of them as rich at last as when they began.

Yours, &c.

JOHN HOUGHTON, F. R. S.



FRIDAY, January 31. 169 $\frac{5}{8}$. NUM. CLXXXIII.

The ill consequences of an open trade to Guinea. The cause of the war with Holland, 1664. and late loss of Gambia. Barbarous or ordinary people seldom have any honour to out-weigh present interest. What foreigners may do if they have forts and we have none. Sir Richard Ford's opinion about the Guinea trade

LAST week I represented some of the consequences of an *open trade* to *Guinea*, if trading at sea upon the coast: furthermore, if while we are thus trading, an enemy should come among us may he not sweep us away at once? Can the natives defend us, or can we always have men of war lie ready to secure so large a coast? Surely none will pretend to it. And that this is not a bare supposition.

All that are versed in the history of the first years of King *Charles's restoration*, must know, that while *our* and the *Dutch* fleet under admiral *De Ruyter* went into the *Streights*, jointly to spoil the *Algerines*, *De Ruyter* did leave us and go to *Guinea*, and thus insulted; which was the cause of the war in 1664. and now lately the *French*, by reason of our weakness at *Gambia*, have destroyed it, and done what else they pleased, agreeable to their opportunity, what then might they not have done with single vessels?

If

of HUSBANDRY and TRADE. 13

If we *land* our goods, shall we not be liable to the insults of the *natives*, who come down from far and strange countries, and when they are gone no body knows where to find them? Or are they more true than other *Barbarians*? Fie, fie, the contrary is perfectly known; they don't consider *futurities*, but lay hold on the present opportunity *per fas nefasve*. Let all the gentry of *England* consider, if it be otherwise by all their ordinary neighbours. Moreover, may not the *Europeans* that have force there, employ some natives, or their men to come and rob us, and easily make pretences 'twas done without their *privity*, and they knew nothing of it.

But farther, if other nations have forts, and we none, will they not keep off all from trading within their gun-shot, but whom they like? Will they not so defend the rivers, as to let none go up or down but themselves, where probably may be the best trading? Will they not have stores and little vessels for to serve the people (when others do not) at their own prizes, which will enable them, when competitors come, to under-sell them? May they not make wars, and then leagues with the *petty Princes*, exclusive of the *English*, as the *Dutch* have often done in *India*? If they have an equal liberty to trade where-ever we do, and by reason of the afore-said trade in a great many places we can't; may they not with that multiplicity out-trade us? Were I there, I should not doubt it. May not they have *factories* up the country which we can't, and so intercept the *trade*? What can't force do beyond the unarmed in a *country*, where the *principalities* are numerous, small and barbarous? What should hinder, but if the *French* or
Dutch,

14 *A COLLECTION for Improvement*

Dutch, or both, should fortify and we not, but they may manage the principal places and shut us quite from that trade; and they that get the *Blacks*, will soon get the trade of the *West-Indies*, and then for a great many other trades both at home and abroad, *good night Nicholas*. I remember when the *African* company was first settled, the Duke of York and several Nobles and merchants met at *Drapers-Hall*, and I went to see *affairs*, and upon an *occasion* Sir *Richard Ford*, who had then a *great name* for *prudence*, stood up and desired that seeing they were settling one of the best trades, that belonged to the *English nation*, they should not differ for small *matters*. Thus much for an *open trade*: about a *regulated company* expect next *Friday* from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, February 7. 169^c. NUM. CLXXXIV.

A regulated company, what. The use of mulcts. Where regulation may be useful, but not to Guinea, and why. Objections answered. A censure of the printed papers.

A *regulated company* to *Guinea* signifies little more than a *free trade*, mentioned in my last: for that is a company of men getting a *charter* for liberty to trade singly to a country, with a power to lay *mulcts* upon themselves, and

of HUSBANDRY and TRADE. 15

and to make *rules* and *orders* how these *congregated* single persons shall manage their affairs.

But what is the money raised by these *mullets* to do? Why truly to pay *rent* for a house of meeting, *committee-money*, an *ambassador* or *consuls* abroad, for *presents* to great men, and several other uses. I can't gainsay, but for *Turkey*, *Eastland*, *Russia* and *Hamburgh*, these may be to very good purpose; but what will it signify at *Guinea*? Will they have an *ambassador* or *consul* at every court there? That would be fine work indeed: for ought I or they know, there are a thousand. Must all these have presents? Or if they have, will they grant you *law*, *privilege*, or *protection*? It's an old maxim, *qui non habet, non dat*. Poor princes! they are not able to help themselves; for they are perpetually in war; and a *prince* to day is sold a *slave* to morrow: and these vicissitudes do very often happen: and if the *regulated company* does not this, what are they better, than if they were in a *freetrade*?

But they can petition the court, and make friends to get convoys to secure them out and home: 'tis true. But if they had power with their own money to set out defensible ships or convoys for themselves, and to manage them as they shall think fit, would it not do as well for them? I believe they would be better pleased; and this I have said will be the case if they trade without force.

But with the four, eight or more *per cent.* pretended to be raised by their *mullets*, they can buy or build *forts*, and have strength agreeable to other folk, this is something: but to what purpose then has been all this clamour against the company trading in a *joynt-stock*? What does this differ from them? Will not these be as much
against

16 A COLLECTION for Improvement

against *interlopers* as they, and so take away the liberty of free-born *Englishmen*? Only indeed there will be this difference in time of assault on their castles, or any other difficulty; the people concerned in the *joint-stocks* will defend to the last penny of their stock, and credit too, when any of the other, if he can get off his own *effects*, will desert, and cry, let the *devil* take the hindmost.

Well, these are but suppositions: it's possible they may get such to serve them as love honour more than wealth; and will spend their last drop rather than betray their trust. 'Tis true, this is possible; but 'tis likely a *joint-stock* may also get such, and they are every man interested to reward and encourage such; when in a *regulated company* some may lose all, and some nothing; and then in probability they'll differ about the *rewards*, according to which men are most likely to take courage.

But suppose they have such *castles*, *ships* and *men*, how will they do in time of war? why, they'll raise *mulcts*. What, whether the ships go or no, or are taken by the enemy? Suppose the scene had been *Turkey*; could the company have raised *mulct* enough to defend themselves there since this war, when in two or three years together there has not come home a ship? Besides when they shall carry their *Blacks* to *Barbadoes*, they'll send the effects got for them in *unmulctable ships*, except you'll put the *West-indies* also into their *charter*: and for the *gold*, how easily can the *mulct* thereof be evaded? For shame, for shame! let's hear no more of it: for 'tis impracticable.

The papers printed in their defence are very mean, made rather to amuse the ignorant, than

convince any understanding man; and I can make them appear so. Let them in few words, and close to the matter, answer this point of *mulets* if they can? Let them not say the government should protect them: for no government will, to run the hazard of its own undoing. Next Friday expect the thoughts of a *joint-stock*, from

Yours &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, February 14. 169 $\frac{1}{2}$. NUM. CLXXXV.

The great advantages of a joint-stock to Guinea. The manner of selling seventy thousand Blacks.

HAVING ended my observations on a free and a regulated trade to Guinea, I now come to consider a *company*, trading thither in a *joint-stock* exclusive; and I must confess, in my apprehension, it bears away the bell: for if they see it for their interest, they can give liberty to any of their servants, or others for a *free-trade* to any particular parts, or for any particular commodities, whereby new trade may be found, or they can for *mulets* let go permission-ships like a regulated company, and have now granted that all that will may fetch *Blacks*, paying to the company twenty shillings the head, or they can, if they find it best, exclude all, and keep the whole to themselves in a *joint-stock* (as the interlopers themselves do in their single ships:)

16 *A COLLECTION for Improvement*

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and by this means they can sell so dear, and buy so cheap, as will enable them to encrease their trade and strength so as to out-vie their neighbours, and if there be any prince fit to make a league with, they can do it either by strength or money; they can draw numbers of *Europeans* to them, which shall so manage the *natives*, as to make *Guinea* (besides the commodities we now have thence) almost as useful to us as *America*; they can by degrees fortifie up the rivers, and lay up magazines, till they understand the heart or utmost of the country, and whence the *gold* comes; they can encourage the planting of *East* and *West Indian* commodities, and have made a considerable beginning in a chargeable plantation of *Indigo*; they can build more or stronger fortifications; they can keep fleets to secure the trade on the coast, or convoy their merchant-men to other places in time of war; they can by several means encourage the *natives* to wear clothes, change fashions, build houses, and do several other things whereby the trade there may be encreas'd; and what may not wealth and strength do?

By this means they can fill the plantations with *Blacks*, and have stock enough to furnish the *Spaniards*, which at this time make overtures to them; and to shew what a trade it might be, take the following account.

The *Spaniards* treated with the royal *African Company* of *England* for five thousand whole pieces of *India* the year for seven years to be delivered at some of the islands.

But to make this good, the company were to ship from *Africa* seven or eight thousand pieces, out of which the *Spaniards* were to chuse five thousand whole pieces, and the company to dispose of the rest.

of HUSBANDRY and TRADE. 19

A whole piece of *India* was according to the ages of the *negroes*, male or female. Those between fifteen and forty five or thirty five were a whole piece; between four and eight were two for one; between eight and fifteen, or above forty five or thirty five, were three for two, and those under four were cast in with the mother.

Now considering the allowances, there were to be ship'd from *Africa* yearly about ten thousand persons, in seven years seventy thousand.

The *Spaniards* not being in good credit, negotiated this by *Augustino Lomelino* and other *Genoefes* bankers at *Madrid*, in and about sixteen hundred sixty four, and transferr'd it to *Signior Ferini* at *Amsterdam*; but the *Dutch* war in 1665 broke all off.

This I have from a gentleman who had the perusal of a book of the letters and negotiations of the treaty.

Such a trade as this made by an act of parliament for ninety nine years certain wou'd much improve all our western plantations, and by degrees perhaps find as good mines in *Carolina* as in *Potosi*; 'twou'd encrease seamen and ships of strength for our use at home, and encourage growths and manufactures here greatly, 'twill bring us in gold apace to make guineas with, and the goods from the plantations will fetch us in silver, besides the silver is gotten for the *Blacks*: and this is what I verily believe might have been already done, had not our misunderstandings hinder'd it; and I do think I shall never meet with the man that can and will fairly gainsay it. But perhaps this is not best for us: for if *Jessurun* shou'd wax fat, he wou'd kick his maker: therefore God thinks fit to let us be

20 *A COLLECTION for Improvement*

divided, which will keep us poor, and perhaps more humble.

What is said for *Guinea*, may serve in a great measure for *India*, *Hudson's Bay*, and several other places.

I desire all who are willing to understand the whole argument, to joyn to this the five foregoing papers.

Next *Friday* expect some account of *Barbary* from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, *February* 21. 1695. NUM. CLXXXVI.

In 1694 came from Barbary two ships; the contents of Barbary. The cause of idleness and penury. A joint-stock proposed for Barbary, and its probable advantages.

FROM *Barbary* came in the year 1694 but two ships; a few for a country of one thousand five hundred miles long, and the breadth from one hundred to three hundred; and that is thought to be one of the fruitfulest countries in the world, which I believe is one of the causes of their idleness and penury. The heat makes them want no clothes, and the plenty makes them want no victuals: therefore what should tempt them to be laborious? they are often in war, and this makes them good horsemen;

of HUSBANDRY and TRADE. 21

men; but trade is little minded, and if any come among them, that would encourage it, they are so barbarous and inconsiderate that they will not miss the present opportunity of getting what they can by *hook* or *crook*, for any good shall be done hereafter; no treaties will oblige them, unless there be a force to back it: therefore some do think, that if the trade of that country were managed by a joint-stock, it would be much the better for them, and bring us a far greater wealth. We might have from thence *gold, copper, ostrich feathers, dates, almonds, wax, gums, horses, goat* and other skins in abundance.

For was there stock enough to bribe the King and great men, and we had great officers abiding constantly there to maintain the grandeur of a company, I do not see but by the favour of those great men, we may penetrate, not only the heart, but as far as the confines of that country; and I have heard, that up high is a correspondency between them and the upper parts of *Guinea*.

This country is bounded on the east with *Cyrenaica*, which I understand is a part of *Egypt*; on the west with the *Atlantick-Ocean*; on the north with the *Mediterranean*, the *Streights of Gibraltar*, and some part of the *Atlantick*; on the south with mount *Atlas*.

Methinks by means of such a company may a great trade be managed between this country and *Spain*, which are always at war: as also between it, *Madera* and the *Canaries*: and why may they not improve the trade with *Algiers* and *Tunis*? The sides of *Atlas* are exceeding fruitful; and methinks there should in so long a tract be some tolerable passage over the *Atlas* into *Lybia*: and whether a trade of slaves might

22 A COLLECTION for Improvement

not be gain'd here as well as at *Guinea*, I'll leave to time and experience: but *Rome* was not built in a day: and if we should get all the trade that a probability may be shewn for, we should out-do all our neighbours.

But how must we gain from thence a better trade, seeing we have not a joint-stock? Why, we must do by their other commodities as at present we do with *ostrich-feathers*, bring them into fashion: and when they see we are great customers, I don't suppose them so barbarous, as not to love the taking our money.

The *Mahometan law* prohibits these *Moors* to drink *wine*; but they'll drink *cyder*; and why they might not be tempted with our *beer* and *ale*, I know not.

Next *Friday* expect a rarity about *navigation*, from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, February 28. 1695. NUM. CLXXXVII.

IN some of my foregoing papers I have given an account of what merchant-ships came to *London* from all parts of the world in the year 1694, which were in all one thousand two hundred thirty eight: I have also made some remarks upon the trade of each place, endeavouring to improve every sort of trade to the benefit of this Kingdom; particularly I have shewn the nature of a free trade, a regulated company, and

of HUSBANDRY and TRADE. 23

a joint-stock trading for *India* and *Guinea*; and I think shewn sufficient reasons why a joint-stock is best for those places. I now shall give a catalogue of floating vessels, and such an one as I believe was never before printed. Now if some would write a book describing them, or of their draughts, I am inform'd 'twould be very acceptable to those that love sea-affairs. The catalogue follows.

Boats.

A jolly-boat
A long-boat
A skiffe
A pinnace
A water boat
A yaul
A ballon of *Siam*
A *Bermudas*-boat
A canoe
A cruckle
A currycurry
A deal-hooker
A felucca
A ferry-boat.
A gondola
A *Groenland* boat
A horse-boat.
A periaga
A pleasure-boat
A ponton
A praw
A flying-praw
A punt
A tilt-boat
A tod-boat
A well-boat

A wherry

Barges

A company's barge
A row-barge
A royal-barge
A sand-barge
A severn-trow
A ware-barge
A *west-country*
barge

Lighters.

A ballast gin
A camel to weigh
ships over the pam-
pus
A close lighter
A hoy
A keel

An open lighter

Galleys.

A barco-longo
A brigantine
A bucentaur
A galeas
A galley
A galley-frigat
A marsiglian

24 *A COLLECTION for Improvement*

A sloop

A tartane

Barks.

A bilander

A saik

A fattee

A skuit

A snaul

A snouke

Fishing-vessels.

A busse

A coble

A cock

A dogger

A driver.

An ele boat

A hebber

A hooker

A north seat-boat

A petre-boat

A smack

A trawler

A trincker

Ships of trade.

A bouyer

A carick

A carvill

A catt

A catamoran

A cott

A crayer

A fluyt

A galcon

A galeot

A hake-boat

A junke

A ketch

A pataph

A pink

A pram

Vessels of war.

A three deck ship, 1st
and 2^d rate.

A frigate, or two deck
ship, 3^d 4th and 5th
rate

A one deck ship, 6th
rate

A boom-vessel

A fire-ship

A hulk to careen

A ketch

A machine-vessel

A smoker

A stage to repair ships

A yatcht

Miscellanies.

A pyramis

A fullet

A sultane

A tow-engine

A yoffe

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRI-

FRIDAY, March 6. 1695. NUM. CLXXXVIII.

My method for natural history. Colour'd earth. Six sorts of stones. A list of vulgar stones. Four hundred sixty eight thousand five hundred thirty six bricks imported; notes on them. A list of burnt clays. Three hundred eighty three thousand pantiles imported. What earthen ware was imported, with a note and proposal.

IN Volume 8, Numb. 169 of these papers, I printed what follows. "I shall give an account of all the ships that came from abroad to the port of London, from *New-Years-day*, 1694, to *New-years-day*, 1695. with the number of them from each Prince's territories; also of all the goods imported that year, and mention'd in the bills of entry, with the quantities imported from each place, and all together. Upon these I shall make some notes *natural* and *political*, striving to make it the best account of trade upon the best and most sure foot that ever has been yet publish'd and I could hear of: and all this I will apply for the benefit of my country; not doubting but it may be made the *richest* and *happiest* the sun sees.

About ships I hope I have perform'd my promise: now I come to *goods*, and shall rank them according to my former method, into *minerals*,
vegetables

26 A COLLECTION for Improvement

vegetables and animals, and first of minerals, and shall begin with the most simple, viz. Colour'd earth, of which there was brought from Holland one thousand two hundred pound, but what this coloured earth is, or what use it is put to, truly I cannot by enquiry at the colour-man's know: but the Dutchmen are to be commended; for they'll hardly let any thing in nature slip without endeavouring to make thence some advantage.

The next matter imported were *stones*: and such Bishop *Wilkins* in his real character, distinguishes into 1. *vulgar*, 2. *middle prized*; *precious*, viz. 3. *less transparent*, 4. *more transparent*; *earthy-concretions*, viz. 5. *dissoluble*, 6. *not dissoluble*.

The vulgar stones he reckons to be *free-stone*, *brick*, *ragg-flint*, *marcasite* or *fire-stone*, *pebble* or *thunder-bolt*, *slate*, *tile*, *whetstone*, *touchstone*, *pumice*, *emry*, *sand* and *gravel*.

Of *free-stone*, viz. the thick massy sort, I find no importation: I presume that *Portland* and other places in *England* furnish us better than any other countries can.

Of *brick* I have already in these papers under my head *clay*, given a large natural history; and I must farther tell you, there came in the year 1694 from *Denmark* seventeen thousand, from *Holland* four hundred fifty one thousand five hundred thirty six, in all four hundred sixty eight thousand five hundred thirty six. These being of small value, 'tis not much material, and might I have my wish, I would not prohibit them; because truly for the most part I think them better than ours; but I would have an encouragement given, to make as good here: and also I would have a pretty high duty, unless they
were

of HUSBANDRY and TRADE. 27

were brought in *English* vessels; and whether they be red brick, or the little grey sort, the reason I suppose will hold the same.

Under this head of bricks I presume may come *pantiles* and all sorts of earthen ware, as *earthen plates, gally-dishes, galley tiles, china, tea-pots, tobacco-pipes, marbles, knickers, bowling-stones, stone-pots, bottles, melting-pots* and *retorts*.

Of *pantiles*, there were imported from *Denmark* twenty thousand, from *Holland* three hundred sixty three thousand, in all five hundred eighty three thousand. Of these we do make a great many more than usual, and hope by the former encouragement we might get the whole trade.

Under the name *earthen-ware* was imported from *Germany* certain, from *Holland* certain forty four times, besides pieces seventy, chests five, baskers thirteen, and cases two, from *Spain* certain. From *Holland* come earthen plates one hundred and eight, gally-dishes dozen one hundred fifty eight, gally-tiles feet seventeen thousand eight hundred and fifty eight, and from *Portugal* dishes dozen seventy. Now these are something valuable; and if we can make them here as cheap and as fine as they are made by our neighbours, I would think well then of a prohibition, but till then, I would rather wish for a pretty high duty (but not so much as shall make them worth running) and allow some to come for samples to us: but when any patent is granted for a new company, 'tis worth while to oblige them to reward him that shall appear yearly to be the best artist: I'll submit to more proper judges; but hints sometimes are useful.

Yours, &c.

JOHN HOUGHTON, F. R. S.
FRI-

 FRIDAY, *March 13. 1695. NUM. CLXXXIX.*

China-ware made at Fulham flat, but not so well round, and why. A proposal for its encouragement. Tea-pots made at Faux-Hall very fine. Brave tobacco-pipes from Holland. Marbles and knickers, how many imported; and how many stone-pots and bottles. A proposal. Melting-pots and retorts, how many imported.

OF *China-ware* I see but little imported in the year 1694, I presume by reason of the war and our bad luck at sea. There came only from *Spain* certain, and from *India* certain twice. 'Tis a curious manufacture, and deserves to be encourag'd here, which without doubt money would do; and Mr. *Dowoit* at *Fulham* has done it, and can again in any thing that is flat: but the difficulty is that if a hollow dish be made, it must be burnt so much, that the heat of the fire will make the sides fall. He tells me that our clay will very well do it; the main skill is in managing the fire. By my consent, the man that would bring it to perfection should have for his encouragement one thousand pound from the publick, tho' I help'd to pay a tax towards it.

Of *tea-pots*, there came but ten, and those from *Holland*. To our credit be it spoken, we have about *Faux-Hall* (as I have been informed)

of HUSBANDRY and TRADE. 29

made a great many, and I cannot gainsay, but they are as good as any came from abroad.

The next are *tobacco-pipes*, of which came from *Holland*, gross one hundred and ten, chests four. I have seen some very long ones, and also small from thence, that truly are very fine. If there comes no more, they'll do us no great hurt. I think they must be permitted to be patterns to set our people on work, and if our smoakers would use none but fine ones, I question not but we should make as fine as any body.

The next are *marbles* for boys to play with, and there came from *Germany* tuns twenty three, barrels ten; from *Holland* sixty two thousand two hundred, and casks ten.

The next are *knickers* and *bowling-stones*, which I take to be all one; if so, there came from *Germany* twenty three thousand, from *Holland* six thousand, besides seven casks; surely a little encouragement would cause them to be made here.

The next are *stone-pots* and *bottles* (I presume 'tis meant *stone-bottles*) and from *Holland* came of the first, twenty one thousand one hundred sixty six casks, and of the latter one hundred ninety one dozen.

We do now make some sorts of them here; but why a little higher duty should not give us more encouragement I see not. And as for the bottles, I should be glad if we had the true art; but I do not remember I have ever seen any of our own making, some should try at the publick charge.

Of *melting-pots* there came one thousand six hundred and ninety four, from *Denmark* thirty seven thousand, from *Germany* forty four thousand six hundred and fifty, besides four vats, and
from

from *Holland* two thousand eight hundred and ninety, in all eighty four thousand and forty, besides four vats. I grudge so great a quantity of these to come from abroad: surely with care we might find earth and skill sufficient to make them here. I am told that at *Deptford* about four miles from *London* they make of some sorts the best in the world, especially for founders.

The next are *retorts*, and of them came from *Holland* sixty four. I hope we may make all the rest that are used; and were our towns encouraged to grow bigger, I doubt not but these manufactures would soon be improved.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, March 20. 1695.

NUM. CXC.

How much imported under the name of stone. Advantage of navigation. Rag-stone what, how much imported, and how much paving-stone and pebbles. A proposal for mending the high-ways.

According to my former method, the next to earthen-ware are stones; and under that name came in the year 1624. to *London* from *Germany* eight hundred and fifty pound, from *Holland* eighty pound, and certain from *Hudson's Bay*, tun twenty. As to the two first I know not what they were; but the last, I suppose, were brought for ballast, and then sold here for money.

ney. Oh the advantage of countries having ships of their own, they can save or gain by every thing.

The next is *rag-stone*, which is a stone of the greater magnitude, used about building of walls, and is of the harder consistence, not easily yielding to the tool of the workman, and grows in great masses. Of this came from *Denmark* seven tuns. I don't doubt but we may have a great deal in *England*; but of the small priz'd stones it may be cheaper to bring them from *Denmark* by ship, than a few mile by land-carriage.

In my last but one I should have reckon'd *paving-stones* among *free-stones*; and of that came from *Denmark* eight tuns, and one thousand six hundred and twenty eight stones, and four thousand six hundred ells, from *Sweden* two hundred stones, and eight hundred and ten ells, from *Holland* two thousand five hundred stones, from *India* eight tuns, and from *America* one thousand two hundred tuns, in all one hundred thirty six tun, four thousand three hundred and twenty eight stones, and five thousand four hundred and ten ells. It's probable all these may not be flat *paving-stones*; but some may be round for pavements of cart-way in the streets.

The next are *pebbles* or *thunderbolt-stones*; and these I presume are used chiefly for paving the high-ways. Of these came from *Guernsey* tuns three hundred fifty four, from *Sweden* tuns eight, and certain, in all three hundred sixty two tuns and certain.

All this is no great matter to supply our *pavements*; but seeing we are islanders, and great numbers of ships causes both our wealth and security, why should we not encourage them as much

32 *A COLLECTION for Improvement*

much as possible? Where wou'd be the inconveniency of having all the towns in *England*, where boats can come, be paved? I know it would make a great employment, not only for vessels on water, but for *carts, horses and men* on land. The charge is not to be considered: for 'tis among our selves and for our great conveniency, it will encrease the towns, and do no more harm than pipes in towns, where water is laid into the houses, and they always improve the place with *plumbers, founders, pipe-borers, paviors and labourers*.

Were I worthy to advise about mending the *high-ways* I would have it done after the following manner. For instance, for *London and Middlesex*, I would have two thousand pound rais'd either out of a *tax-bill*, or by *tax* laid on those places. With one of these two thousand pounds, I would have fifty pound the year purchased in good land, and with the other money shou'd be built houses and conveniences for stores. Here shou'd an expert man, call'd a *road-master* live, like the *bridge-master* in *Southwark*, and have the revenue for his wages. All the *high-ways* shou'd be mended by his direction, and except where necessity urged, all the money gathered shou'd be laid out on one road one year, and on another road the other year, for a certain space, till they were as substantially mended, as art cou'd mend them.

Next *Friday* expect more on this subject from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRI-

FRIDAY, March 27. 1696. NUM. CXCI.

A road master shou'd be a good beggar, and to what purposes. He shou'd be a Mathematician. The Roman roads in England and conquerors, how both were made.

IN my last I promised to say more about *road-mending*, which is, that I would have the *roadmaster* a good beggar, like Mr. Treasurer *Haws* at *Christ's Hospital*; and when any rich man lay sick, that had got his estate by *carriers* or *waggoners*, he shou'd be courted to leave something to this good purpose; and as the wealth encreased, the roads shou'd be much beautified, or the charges of the inhabitants shou'd be abated, and I doubt not but in a few years this wou'd be.

I wou'd have a check on this *road-master*, by such as authority shall best approve on, but always have him a *mathematical man*, and 'twill be his interest to learn all the ways of mending roads, that mankind knows; and his country's interest to have all the knowledge and experience registred in a fair book (belonging to the office, and not to be alienated) with a good margin, to write the head of the matter in; and till he learns better, let him take what I have picked up.

Dr. *Robert Plot* in his tenth chapter of the natural history of *Oxfordshire*, tells us, that the *Romans* took great care of their *roads*, and called some *publick* and some *vicinal*. The *pub-*

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lick

34 A COLLECTION for Improvement

lick were called *regiæ, prætoria, consulares, militares, privilegiatæ, illustres, frequentatæ, celebres, eximie, &c.* and after by the conqueror *William Chemini majores*; of which sort we had in England but four; *Watling-street, the Foss, Ikenild-street, and Erming-street*, whereof two stretched themselves from sea to sea, the length of the land, and the two other the breadth.

Besides these, there were many others of like erection, tho' of less extent, by the ancient Romans called *vicinales*, i. e. from colony to colony, which were also publick, if compared with the private agrarian ways. And these were by King *William* called *Chemini minores*, and were the ways expressly described in the laws of *S. Edward the Confessor*.

Both these ways were sometimes raised, sometimes level, and sometimes trench'd; and the raised ones sometimes only of earth, and sometimes paved, especially in moist and boggy grounds; although sometimes where little need, as he thinks, to employ the foldiers and common people, to keep them from worse mischiefs: but where they were laid through meers and low-places, and necessity caus'd them to raise and pave them, they first laid out the bounds, then dug trenches, removing the false earth, then fill'd them with sound earth, and pav'd them with stone, that they might not sink, or otherwise fail.

In this author's history of *Staffordshire*, chap. 10. he tells us of the way being made of gravel, and a little farther, of two pavements one above another at least four foot, the uppermost (which lay within eighteen inches of the surface) being made for the most part of lime and rubble-stones, and the lowermost of pebbles and gravel

of HUSBANDRY and TRADE. 33

vel knit together with a very hard cement, about four inches thick, laid upon a foundation of Roman brick; and under them, bolder-stones of a foot thick more.

A great deal more he says about Roman ways: but to his book I refer the reader. I wou'd not have put so much here if I cou'd well have left it out.

Next Friday expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, April 10. 1696. NUM. CXGHI.

A preface. A road well mended in Oxfordshire, Hertfordshire, Deptford, and Holland.

IN my first volume is the nature of earth, water, air and fire, with their effects and reason of many of their operations: in my second, *Natural History*, with the taxes, number of acres, houses, &c. in each county of England, with notes, particularly of Yorkshire and Derbyshire: in my third the doctrine of fermentation, history of cyder and clay: in my fourth, a continuation of clay and all its uses I could learn, with the history of wheat: in my fifth, the history of joint-stocks and kine: in my sixth, I went on about kine, and have shewn the use and manufacture of most parts: also in order to nutrition, I have shewn the circulation of the blood,

36 A COLLECTION *for Improvement*

with some reasons why it rises from low to high parts; and also the manner how bones and other parts grow: in my seventh I have carried on the history of *kine* in discourses upon *blood, butter, cheese, cows, cream, dung, milk, urine, whey*, and several particulars: in my eighth I have given an account of all the ships that came from abroad to the port of *London*, from *New-Years-Day*, 1694. to *New-Years-Day*, 1695. with the number from each Prince's territories: also of all the goods imported that year, and mentioned in the bills of entry, with the quantities imported from each place and all together. Upon these I have made some notes natural and political, as the advantage of a coalition with *Scotland*, the true case of a free trade, a regulated company, and a joint-stock, with a method for mending the roads, &c. striving to make it the best account of trade, upon the best and most sure foot that ever has been yet published, and I could hear of: in this I shall go on to shew the advantages to be made of imported goods: and all this I will apply for the benefit of my country; not doubting but it may be made the richest and happiest the sun sees.

In my last, save the index of the eighth volume I gave some account of the *Roman* ways, from *Dr. Plot*, and I am informed that ——— *Dugdale* has wrote on the same subject.

Once I rode thro' *Oxfordshire* near *Blechinton*, a seat belonging to the Earl of *Anglesey*, where I think for a quarter of a mile at least, was made cross a deep valley a substantial *high road*, covered with *chalk*, by reason of the deepness on each side: here cou'd lie no water except in the holes made with horse-feet and wheels, and I doubt not but those are easily mended and

of HUSBANDRY and TRADE. 37

kept in repair, tho' I doubt whether they have any gravel near.

Mr. *Ghauncey* of *Hertford*, that has often been under-sheriff of that county, has told me that about sixty years since, there was a great complaint made to the sessions of an intolerable bad way near *Bayford*, not far from *Hertford* which was ordered to be mended substantially with a good ditch on each side by which means and a little yearly care 'tis a good road still.

I am told there is something done at *Puckeridge* in the same county, that is very substantial.

And I am informed that at *Deptford* they laid flints a foot thick, and then covered them with gravel, which makes a good road.

But in deep clays flints will sink, there make bricks with it, and with them arches, and in *Holland* some mud makes bricks for the same purpose. Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, April 17. 1696. NUM. CXCIV.

A farther account of mending roads, particularly at White-Chapel and White-Hall. Charities towards mending ways. Dr. Harvey and a clothier. Of state and whetstone.

IN the time of King *Charles* the second, Sir *John Robinson* being Lieutenant of the Tower,
D 3 used

used to go hunt often into *Epping-Forest*, but the ways without *White-Chapel* were very bad and troublesome to him, upon which he was resolved to have them mended, either by indictment or other way: upon this (as I have been informed) were laid cross the ways, trees, earth, and then gravel, and ditches were made, which made it good for the present; and to keep it so every year, in the middle is laid a high row of large gravel, which is forced in, and keeps that part highest to throw off the water, and the dirt is press'd or cast into the ditches, which are every year cleansed, and thus it's likely to last for ever. Indeed by reason of its being a *flat*, in the winter 'tis pochy, but it's generally without holes and even.

Sir *Christopher Wren*, the King's surveyor general, told me that when he came first into his place, he found the way by the privy garden, between the two gates at *White-Hall*, to be extreme bad, and it had baffled all his predecessors by means of being an ill earth; upon this he dug it down (I think) two feet, and there pitched and rammed it well: upon that he threw what came out, and pitched it again substantially, and it remains firm to this day, only must be mended what the coaches wear out.

To add to my proposal of mending the highways, and the history how some have been mended, I must tell you that one Dr. *Harvey* (the inventor of the *Harvey-apple*, master of *Trinity-Hall* in *Cambridge*) about sixty years since, left an estate to mend the roads *versus Londinum* (towards *London*) and 'tis as well mended as any in *England* to *Fulmer*, six miles. *Vide Fuller's History of Cambridge.*

And

And I have heard of a clothier near *Colchester* that gave money to mend a road two miles, and I question not but the road-master I formerly mention'd would procure great sums for this purpose: and so much for mending roads and pebbles.

The next *slate*, which is a natural stone of a laminated figure (dividable into thin plates.) Of it came from *Germany*, three hundred and fifty bundles of books, and thirteen thousand pens. I know little other use of this stone except for tables, and I do not know that we have any in *England*; therefore we must encourage their importation.

Of a coarser sort of *slate* we have a great deal in *England*, particularly Dr. Plot says, that in *Oxfordshire* with them are covered houses, whereof the lightest and what imbibes the water least is best, and some of them are of so hard and close a texture that painters of good skill prefer them before *marble* for grinding their colours.

The next is *whetstone* which is used for sharpening of metal. From *Denmark* came twenty two thousand four hundred, from *Germany* three hundred, from *Holland* five thousand four hundred and eighty, in all twenty eight thousand four hundred and eighty. These are useful good things and do us good; may they come in greater plenty.

Next week expect farther from

Yours, &c.

JOHN HOUGHTON, F. R. S.

 FRIDAY, *April 25. 1696.* NUM. CXCIV.

Dog-stones. *The Dutch are an industrious people. Middle-prized stones. A catalogue. Alabaster, marble, agat, chrystal; glass, how made.*

AMong the small-priz'd stones, I think I may reckon *dog-stones*, of which came from *Holland* twenty eight last: *grave-stones*, of which came from *Holland* seventy six: *mill-stones*, of which came from *Holland* sixteen: *quern-stones*, of which came from *Holland* seventy three last.

The inference I have to make on these, is, that *Holland* is a delicate country: almost all things in the world grow there; that is, by their industry they procure it, and out of these stones suck honey. I cannot but commend them; but were I worthy to advise, I'd soon have *England* as productive as they.

Thus much for vulgar stones and mending high-ways: now for the *middle-pris'd* stones; and them Dr. *Wilkins* reckons to be *alabaster*, *marble*, *porphyry*, *agat*, *jaspis* or *heliotrope*, *lazuli* or *azure stone*, *chrystal*, *glass*, *selenite* or *Muscovia-glass*, *isnglass*, *sparr*, *chalk*, *loadstone*, *cadmia* or *calaminaris*, *amianthus* or *asbestus*, *coral* or *coralline*, and *amber*.

The first is *alabaster*, and there came from *Holland* one dozen figures, and fourteen boxes:
of

of HUSBANDRY and TRADE. 41

of these there has been a very great trade, but I question whether they are worth prohibiting.

The next is *marble*, a stone in time of peace and plenty much used; but however, there came two thousand four hundred and nineteen of them from the *Streights* in 1694. and also ten blocks and one hundred ninety five mortars.

Of these there is not much to be said, unless we could improve the art of polishing, or get an engine to make mortars.

The next stone to *marble* is *agat*, which is a middle-pris'd stone of a shining politure or capable of it, of divers colours, growing in small masses.

Of this came from *India* in pieces for hafts one thousand three hundred and fifty six in the year 1696.

Truly they look very pretty, and there are a great many pretty things made with them, as cabinets, spoons, hafts, beads, &c. and they are formed in *India*. I wish we could find some engine to out-do the cheap work of the *Indians*, and then it might be made a considerable trade here.

The next is *chrystal*, which is a transparent brittle natural stone; and of this came from *Portugal* six hundred pound, from *Spain* certain and from *Holland* in beads eighty six thousand pound.

Methinks if we would we might get this stone, and make it into beads or other manufacture, as well as our neighbours.

The next is *glass*, which is a transparent, brittle, factitious stone, and an account of this I cannot give better than the learned Dr. *Willis* in his book of fermentation has done to my hand, and he says, that *vitrification* (glass-making) (which is also said to be the last mutation of bodies, of which *nature* is capable, and from which there's

no

42 A COLLECTION for Improvement

no going back) depends upon a fused salt, and united to an earthy matter, even to its smallest particle: for when either matter is fused by a most vehement fire, and divided in its smallest parts, the bodies of either being put into a flux are by so strict a union joined together, that afterwards they are never to be pulled asunder.

There are many ways of vitrification, to wit, of *sal alkali*, with sand or a sandy matter fused together by a violent fire, common glass is made, which is transparent both by reason of the abundance of salt, and of the clearness of the sand, of which next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, May 2. 1696. NUM. CXCVI.

No wonder glass is made with sand. Divers sorts of glass. The reason of glass-making. Neri's book. The Duke of Buckingham and Mr. Ravenscroft. The advantage of stock-jobbing. What glass, window glass, glass-bottles, glass-pipes, bugle, looking-glasses, necklaces and prospect-glasses, were imported to London in the year 1694.

FEW will wonder at the making of glass sand, when the little stones of which it is made

made shall be shewn them in a *microscope* (magnifying-glass:) for there each of them appear like great pieces of *rock-allom* in divers figures, clear and shining. Wherefore, as the doctor says, salt promotes the fusion of that clear matter by fire, and then is admitted into its most strict embraces, being fused.

Beside this sort of glass, some of divers colours and consistencies are made of *minium* (red-lead) the *calx* of *tin*, *antimony*, and some other minerals (when the sulphureous part doth first fly away) fused, now by themselves, now with flint or sandy matter. The reason of all which consists in this, that *salt* and *earth* being most smally broken by a violent fusion of fire, and being divided even to their least particles, catch hold of one another, and so are bound together, by the most strict bond of the mixture. The coalition or coupling of these is never to be dissolved; because there is wanting in the mixture other principles which might unlock the frame of the subject: yea, salt and earth, being joined by the mediating fire, do so intimately cohere, that they affect not divorces from themselves, nor suffer them from another. Thus far the learned Dr. *Willis*.

There was one *Neri* who wrote a book about the art of glass; and this is translated into *English* with some notes of Dr. *Merret's*, where more may be seen at large.

According to my information we are of late greatly improved in the art of *glass-making*: for I remember the time when the Duke of *Buckingham* first encouraged *glass-plates*, and Mr. *Ravenscroft* first made the *flint-glasses*: since that we have mended our window-glass, and out-do all abroad: and whate'er may be said against
stock-

44 A COLLECTION for Improvement

stock-jobbing, yet it has been the means to raise great sums of money to improve this art; and seldom is there much money laid out in the kingdom to encourage any trade, but the publick is the better, whate'er the gain or loss of the proprietors may prove, *caveat emptor*.

But notwithstanding this improvement of our glass, I find our neighbours will have a share: for in the year 1694. was imported to *London* under the name of glass and window-glass from *Germany*, forty chests, ninety gross, ten wey, and sixty casks. Of glass-bottles from *Sweden* eight dozen. Of glass pipes from *Holland* seven hundred sixty nine, from *Flanders* six hundred seventy five, in all one thousand four hundred and forty four. Of bugle from *Germany* three hundred and eighty eight pound, from *Holland* five thousand six hundred and twenty six pound, from the *Streights* fourteen thousand one hundred and eighty five pound, and from *America* six hundred and fifty five pound, in all twenty thousand eight hundred and fifty five pound. Of looking-glasses from *Germany* gross one hundred and six, from *Holland* gross eight, in all gross one hundred and fourteen. Of necklaces from *Germany* gross four hundred and sixty, from *Holland* gross one hundred and seventy five, from *Flanders* gross eight, from the *Streights* in number five hundred and sixty, in all gross six hundred and forty three, and in number five hundred and sixty. Of prospect-glasses came from *Holland* four dozen. And of smalts came from *Germany* seventy thousand seven hundred and forty four pound, from *Holland* seventy seven, in all seventy thousand eight hundred and twenty one pound.

of HUSBANDRY and TRADE. 43

All these put together make a good handsome quantity; but severally, they deserve some remarks: which you may expect in the next from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, May 8. 1696. NUM. CXCVII.

Flint mum-glasses *encouraged*, and window-glass of which we make the best in the world. Glass-bottles we hardly import any. Glass-pipes. Bugle we ought to encourage. Looking-glasses. We import too many. Norwich and Nuremberg. Necklaces, prospect-glasses. *An account of glass-houses in England promised.*

IN my last I promised some remarks upon imported glass. The forty chests may be window-glass or drinking; but the ninety gross I presume to be mum-glasses; if all the chests were so, 'twou'd make no great importation; and seeing Germany is so fair a correspondent, and usually takes off our commodities for theirs, I cannot think it convenient to prohibit this trade; but if we'll encourage our own *flint mum-glasses*, and make them the fashion, we shall quickly lessen the others without giving offence.

46 A COLLECTION for Improvement

As to the ten *wey* and sixty cases, I am informed 'tis *window-glass*, and that a *wey* is three cases, and a case is about six score, or not so many: so that here is but twelve score cases, and at most about twenty eight thousand eight hundred plates, of perhaps about a foot and half diameter: and this same in likelihood will decline: for our ordinary glass is as good and as cheap; so that this is seldom brought, except when other profitable goods can't be had, or the freight through scarcity is very cheap; but in fine window-glass we now out-do not only *Germany* and *France*, but all the world beside.

The next are *glass-bottles*, but I presume their importation we have quite spoiled; because I find only from *Sweden* eight dozen.

The next are *glass-pipes* of which came one thousand four hundred and forty four. These can hinder our trade but little.

The next is *bugle*, of which came twenty thousand eight hundred and fifty five pound. This is somewhat considerable, and methinks shou'd deserve a joint-stock to carry it on, as a great many others.

The one hundred and fourteen gross of *looking-glasses* I understand to be the little ones, which we in *England* hardly think worthy our making; but I would have it consider'd that there is no manufacture so mean as not to make the town rich, where it is followed by many hands; and to the best of my remembrance Dr. *Chamberlen* in his Present State of *England*, says, that children in and about *Norwich* between six years old and ten, earn ten thousand pound a year more than what keeps them: and *Nuremburg* in *Germany* is a famous place, tho' a great part of their trade is excessive cheap toys and boxes.

Of

of HUSBANDRY and TRADE. 47

Of necklaces came six hundred and forty three grofs, and in number five hundred and fixty nine, but in these I am told we out-do our neighbours, and are likely in short time to serve other countries.

The four dozen *prospect-glasses* amount to nothing worth speaking of, and they are the mean sort: for Mr. *Yarwell* in *St. Paul's Church-Yard*, Mr. *Marshal* in *Ludgate-street*, and divers others have brought the art to such perfection, as that I do not doubt, but for good ones, they'll vie with the best foreign workmen.

Here I should have ended my account of *glass*: for to tell of the variety of making glass in *England* is not my proper business, for I am on imported goods; but to give some history how this trade came, and how it has been improved in late years, would be acceptable to many; but it is hard to get an account how much glass is made and to what value: but such as I can you shall have, viz. an account of all the *glass-houses* in *England* and *Wales*, the several *counties* they are in, the number of houses in each county, and the sorts of glass each house makes, which expect *Friday* next from

Yours, &c.

JOHN HOUGHTON, F.R.S.

FRI-

FRIDAY, May 15. 1696. NUM. CXCVIII.

Number of glafs-houfes in England. How many for each fort of glafs.

THO' England be very backward in invention, yet to shew how good they are at improving of arts, I take the account I promised in my last as follows:

An account of all the glafs houfes in England and Wales.	Theseveral counties they are in.	The N ^o of houses	And the forts of glafs each house makes.
In and about London, and Southwark, }		9	For bottles.
		2	Looking-glafs plates,
		4	Crown-glafs and plates.
		9	Flint, green and ordinary.
Woolwich, }	Kent, }	1	Crown-glafs and plates,
		1	Flint, green and ordinary.
Isle of Wight, }	Hampshire, }	1	Flint, green and ordinary.
Topsham near Exon. }	Devonshire, }	1	Bottles.
Oddam near Bath, }	Somersetsh. }	1	Bottles.
Chellwood, }		2	Bottles and window-glafs.
		5	Bottles.
In and about Bristol, }		1	Bottles and window-glafs.
		3	Flint, green and ordinary.
Glocester, }	Glocestersh. }	3	Bottles.
Newnham, }		2	Bottle-houfes.
Swansey in Wales, }	Glamorgan. }	1	Bottles.
Oaken-Tate, }	Shropshire, }	1	Bottles and window-glafs.
Worcester, }	Worcestersh. }	1	Flint, green and ordinary.
Covenstry, }	Warwicksh. }	1	Flint, green and ordinary.
		1	Window-glafs.
Stowerbridge, }	Worcestersh. }	7	Bottles.
		5	Flint, green and ordinary.
Near Liverpool, }		5	Flint, green and ordinary.
Warrington, }	Lancashire, }	1	Window-glafs.
Nottingham, }		1	Bottles.
Answorth, }		1	Flint, green and ordinary.
Custom-more near }	Nottingham. }	1	Bottles.
Answorth, }		1	Bottles.
		1	Bottles.
Near Silkstone, }		1	Flint, green and ordinary.
Near Ferry-bridge, }	Yorkshire, }	1	Bottles, flint, green and ordinary.
		1	bottles.
Kings-Lynn, }	Norfolk, }	1	Flint, green and ordinary.
Tarmonsh, }		1	Bottles.
		6	Window-glafs.
New-Castle upon Tine, }	Northumber-land, }	4	Bottles.
		1	Flint, green and ordinary.
		90	

Note, Some of these houfes are not at work.

Hence

of HUSBANDRY and TRADE. 49

Hence may be noted that the places where glass is made in *England* and *Wales* are only in the two chief cities, viz. in *London*, where there are twenty four glass-houses, and *Bristol* with nine; besides fourteen counties, viz. *Devon* having one, *Glamorgan* one, *Glocester* five, *Hampshire* one, *Kent* two, *Lancashire* two, *Norfolk* three, *Northumberland* eleven, *Nottingham* five, *Salop* one, *Somerset* three, *Warwick* one, *Worcester* eighteen, *York* three; and all the other thirty eight counties have none at all, and how much it is to their honour and advantage, I wish this may make them consider. It may farther be noted that the houses for bottles are forty two, crown-glass five, flint green and ordinary twenty eight, looking-glass plates seven, and window-glass eighteen.

Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, May 22, 1696. NUM. CXCIX.

A letter about glass-making. Lime-stones, not fit for glass. What fittest. Where the best kelp.

SIR, the account, I promis'd you of glass, take as follows.

THE variety we observe in glass depends, I conceive, wholly upon the different fineness of the ingredients; that is, of the salt or

50 A COLLECTION for Improvement

stones. To make good, that is, transparent glass, each of these ought to be prepar'd by reducing them into a fine powder; washing, sifting and exactly mixing them: for if the materials are not well mix'd, the glass will be knobb'd, and in some parts *opaque* (not to be seen through) since the transparency of it depends upon the perfect union of the minute parts of *stone* and *salt* in fusion; which they cannot have unless the minute parts are well mix'd before-hand.

No stones, which will burn into lime, are fit for making glass: any other are, but the best are *chrystal*, *flints*, *pebbles* and *sand*. The sand must be white, small and well wash'd. Our glass-men for making the best flint-glass use instead of powder of flints a very white sand, such as we strow upon writing, which is commonly brought from *Maidstone* in *Kent*. The sand which serves for common glass is grosser and less white, and comes hither from *Woolwich* and other parts.

As for salt, the other ingredient of glass, 'tis us'd either refin'd from earth or unrefin'd. The most refin'd salt is made by taking a *lixivium* (lee) of the ashes of *Kali* or pot-ashes, with a good quantity of fair water, and decanting (pouring) it often from one vessel to another till the earthy part be well separated; and then evaporating it to a fine white salt; with which, and the powder of chrystal or the finest white sand, the best chrystal-glass is made. I am told that our glass-men do, instead of this salt, for chrystal-glass, use salt-petre. Our second or ordinary glass for windows is made of white sand, and the ashes of *Kali* or *glass-wort*, which, if it be in hard lumps, is what our glass-men call *kelp*; if not, 'tis call'd *pot-ash*. 'Tis certain that the more alkalizate salt the ashes of any vegetable

of HUSBANDRY and TRADE. 51

getable afford, the better those ashes serve for making of glass.

Now *kelp* and *pot-ashes* are made of sea-plants (which by reason of the place of their nativity are strongly impregnated with salt) such as the *Alga* and *Fucus Marinus*, of which there are many kinds, but those are of most common use, which we in *English* call *sea-thongs* or *laces*. When the weather is tempestuous, these seaweeds are cast up in great quantities upon the shores, taken up by the cottages, and dried in the sun like hay; and when dry, burnt to ashes, which are call'd *cineres clavellati* or *pot-ashes*. If they dig trenches in the earth near the shore, and upon wooden rafters or iron grates plac'd a cross them lay heaps of this herb being first dry'd in the sun, and so set fire to them; the ashes and salt contain'd in them being fus'd by the fire, will fall into the trenches and cake together into a crusty substance, of partly a black and partly an ash-colour, which is what our glass-men call *Kelp*. It is observable that the hottest and driest countries afford the best *Kelp*; because the heat of the sun continually exhaling the phlegm or watery-part, the salt remains in a greater proportion. There is a very good sort comes from *Cartagena*, a better from *Alicant* in *Spain*; but the best of all comes from the *Levant*, being brought chiefly from *Tripoli* in *Syria*, and *Alexandria* in *Ægypt*. They sow the seeds of *Kali* or *glass-wort* in these warm countries in places remote from the sea, and are very careful in ordering and managing of it; also in keeping the *Kelp* or *rocket* clear from the mixture of gravel or earth, so that they have it very fine.

Our green glass, or glass for bottles is made of any sort of ashes well powder'd, and ordinary

52 *A COLLECTION for Improvement*

sea-sand from *Woolwich*, &c. This is what at present occurs on this subject.

By another I understand they use *kelp* and *pulverine*, which are still but a finer sort of *pot-ash*.

Our whitest sand comes from the *Isle of Wight* and *Maidstone*.

Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, May 29. 1696.

NUM. CC.

An objection and answer. Increase of manufacture here will increase importation of foreign goods, and our naval strength. This illustrated by divers observations. An advice about wealth.

UPON what I have said of *glass* and several other things, will arise an objection, which is, if we should get all the trades in the world, we must shut our selves from the world: for if we have nothing to buy from abroad, we cannot sell, and so shipping will decline, and we may be subject to any potent invader. This strictly taken, I grant: but I suppose it will never be so; for let us be as industrious as possible, to get all arts hither, yet seeing that invention is tied to no place, some in other countries would invent several curiosities that we rich traders would be glad to purchase; besides, necessity is the mother of invention, and we should make a great many

2

countries

countries necessitous; and their poverty would make them think half the pay an *English* man would ask for a day's labour, a good reward to them; by this means a great many things will be made abroad, that we shall need either for use or pleasure. Farthermore, tho' most sorts of *animals* and *vegetables* may by art be encreas'd here, yet for exotick (foreign) minerals, 'twill be hard to get without giving our product or manufacture in exchange; and the richer we are the more will we give for what we have a mind to; besides there are abundance of foreign growth, as *spice*, *wine*, *oyl*, *silks*, &c. that 'twill be cheaper to build ships, and fetch them, than produce them here.

This encouragement of manufacture and other trade will encrease people here in proportion, and also wealth, which will encrease luxury, and cause greater consumption of foreign commodities; so that here will be a greater importation than was before; and not only so, but a far greater inland and coasting trade; by which means so long as ever we shall be unanimous, and mind our business well, we shall have such *naval* force, as I think will put us past fear of being hurt by any of our neighbours.

To illustrate these things, I pray consider, may not an *Italian*, a *Greek*, or a *Russe*, have a *Bezaleel's* head to find out *painting*, *carving*, *weaving*, *printing*, or divers other arts, either better or in some other delightful manner than we do? May there not in other countries be an *Hevelius*, a *Lewenboek*, a *Homer*, a *Virgil*, a *Horace*, or such like? May not a *Bartholine* take as much pains to know art in *Denmark*, for three-score pounds the year, as some will do here for three thousand? And will not the poor *Russe* and

54 *A COLLECTION for Improvement*

Indian do as much work for a *groat*, as many of us will do for a crown; and is it not the like in other countries? Will it be worth our while to plant *spice* and *cotton* here, sufficient for our use, when we can have them cheap from abroad in exchange for our goods? Shall we keep fish-ponds, for the breed of *whales*, *sturgeon* and *cod-fish*; or parks for the beasts of the universe, that we may have their skins at home? No, no, let's do what we can to improve our trade at home, and without doubt that will ne'er lessen it abroad.

Tho' by the hints and proposals I often make, we should grow excessively rich, let's use it well: for God can when he pleases, by *war*, *famine*, *plague*, or any other ways, cause us to send our wealth away by wholesale, to furnish us with what, not only *nature*, but our *habits*, has made necessary. Wherefore let all strive by honest industry to live as well, and get as high as we can; tho', like flies, when we have crept to the top of the glass we fall down again, and happy is that man whose sins are not the cause of his fall.

Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, June 5, 1696.

NUM. CCI.

Muscovia-glass, *what*. *How much imported in one thousand six hundred ninety four.*
Its uses. Several sorts at Gresham-college.
 Lapis Calaminaris, *of what use.* *How much imported.*

THE next sort of stone to glass is *selenite*, *Muscovia-glass*, *isling-glass*, or *sparr*. This is a sort of the greater transparent *fissil-stones*, that will divide into flakes. There came from *Germany* in the year 1694 a thousand and sixty pounds; but I have heard it comes from other places, it's likely from *Muscovia*; but particularly it comes from *Hudson's-Bay*; and as I have been told, 'tis dug out of excessive hard stone, and is up and down in it in irregular figures.

The chief use I can learn it is put to is like glass-windows to give light into ships, where it is not so like to be broken by the moving or other accidents, as glass would be.

Another use is to lay over some lamps; for it will not burn with such heats, and on it may be laid either wet or dry perfumes. There is a tin-shop by *Fleet-bridge* that has been famous for such lamps. 'Tis also used for covering of pictures.

The ingenious Dr. Grew in his *Musæum Regalis Societatis*, says there is at Gresham-college a *rhomb* of *Muscovy-glass*, and 'tis call'd not only as above, but also *maria glacies*, *magnetis* and

36 A COLLECTION for Improvement

talk, to which 'tis nearest of kin, being insensible of *acids*, and consisting of very thin, perspicuous, glossy, parallel, and flexible *plates*, seldom found figured, except in a diamond-square, *i.e.* with unequal angles and equal sides, whereas in *Talk-Chrystal* both are unequal. 'Twas taken out of Mount *Hæmus*.

Also a very white piece of *Muscovy-glass*. Another of a pale-green with a kind of silver gloss, and semiperspicuous. Another of the colour of tarnish'd *copper* mix'd with black.

Also a lump of *selenites* immers'd in small pieces in a whitish stone, a little *diaphanous*, and so hard as to cut glass.

This, he says, grows also in *Cyprus*, *Sicily*, *Saxony*, and many other places, used in *Germany* in *windows* instead of glass. And *Ambrosinus* mentions a lead colour'd sort, so big as to make not only tiles, but tables.

To this effect the doctor.

The next is *Cadmia*, or *lapis calaminaris*, which is a sort of stone that will give to copper both weight and colour, and thus is *brass* made.

There was imported in one thousand six hundred ninety four from *Holland* fifteen hundred weight and five hundred fifty six pounds. I am told that we have a great deal of it in *England*, particularly in the forest of *Dean*, just by the *Severn*-side, and that we were wont to send a great deal abroad; and it is much, that seeing we have very great quantities of it and copper, we never fell to this manufacture before now; neither in probability had we now, had it not been for necessity and stock-jobbing.

It is used in physick, and fam'd for the cure of fore-eyes.

It's

of HUSBANDRY and TRADE. 57

It's probable I may say more of it when I shall treat of brass.

Next Friday expect more from

Yours

JOHN HOUGHTON, F. R. S.

FRIDAY, June 12. 1695. NUM. CCII.

Alumen plumosum, *its description and use.*
Amianthus-Rock, *its description, and others.* Where this stone is found. Manufactures from it. An ointment with it. How much imported in one thousand six hundred ninety four. 'Tis good for lamp-wick.

THE next is *alumen plumosum, amianthus, asbestus.* This is a stone of an incombustible nature, it seems hard like a flint, and yet by little and little one may pull it in pieces, and is as if it were a skein of silk folded together into an excessive close consistence; it is spun into thread and wove into cloth, and when it is soil'd it may be thrown into a strong fire, and there be kept red-hot, and when taken out, and cool, 'twill be clean and white as milk; and this may be done *toties quoties.* Whether it may be useful in bags to burn any thing in, I'll leave it to the consideration of those who have occasion for such. There is a piece of this cloth, and some paper in the repository of the *Royal Society*, but
I think

58 *A COLLECTION for Improvement*

I think it was brought thither since Dr. Grew wrote his book of the rarities there, altho' the stone he calls *thrum-stone*, and says it grows in short threads or thrums from about a quarter of an inch to an inch in length, parallel and glossy, as fine as those small single threads the silk-worm spins, and very flexible and like flax or tow. Nothing answers it better than the hard fibrous part of a large oyster, when 'tis stew'd. There are several pieces both white and green, of which the fatter hath the longest threads, and the most flexible.

There is a piece of *Amianthus-Rock*, in which the thrums (about one fourth of an inch in length) lye in layers between several beds of a green stone, in some places of a reddish brown.

There is another with veins and layers between beds of bluish colour: also a bastard sort that grows in veins in a clayey and mundick load, between beds of a greenish earth, the threads near half inch long of a glossy black and brittle: given by Mr. Colepress, who observ'd it amongst the *Cornish* mines.

The best is found in *Cyprus* and *India*. Of late very good in some mines in *Italy*, of which see *Philosophical Transactions*, Num. 72. It was anciently spun like tow into sheets, in which the bodies of princes, laid on the funeral pile, were wrapt up, to keep them entire when they were burnt, from the other ashes. These sheets were clean'd by burning, being insuperable by the fire, from whence the name of the stone. *Septalius* hath, or lately had *thread, ropes, paper, and netted works* all made hereof.

Boetius describes an ointment made hereof, which he highly commends against the sores on childrens heads, called *tinea puerorum*, and ulcers in the legs. It hath no sense of acids. There

of HUSBANDRY and TRADE. 59

There came from *Holland* of this stone fifty four pound *Anno* 1694. But truly what use we in *England* do put it to I cannot yet learn, except it be to serve in lamps for wicks instead of cotton, where I am told it does excellent well, without making snuff that will waste.

I know there are but few that mind these things; the more the shame and pity. Will any glory in their ignorance? Surely, as the great Lord *Bacon* says, whatever God thought worthy of essence, shall not man think worthy of science? And I verily believe the generality spend a great part of time as idly in many other things, as in the contemplation how stone may be spun. However, please or not please, I must go on my method, and next week for corals, from

Yours,

JOHN HOUGHTON, F. R. S.

FRIDAY, June 19. 1696.

NUM. CCIII.

Coral, *what.* Several sorts of coral is gotten. Its generation. Bastard-coral. Use of coral.

THE next in course is *coral*, which Bishop *Wilkins* reckons among the middle priz'd stones, and says, it is of a *strange original*, not being properly a *mineral*, but a *submarine plant*.

And Dr. *Grew* in his *Museum Regalis Societatis*, says, it has a resemblance unto *plants*, and a near analogy to *stones*.

There

60 A COLLECTION for Improvement

There are many sorts of *coral*, particularly there are in Gresham-College repository a piece *smooth, white and solid*, with its root spread abroad upon a *chalkie-bed*: a piece of *solid red coral*, and a large knotted trunk of the same; also a piece of *solid coral* both red and white, growing together. The root of a *solid red coral* spread upon the trunk of a *white coral*: also the *shrub-coral*, *corallium fruticosum*, and the *kneecoral*. A joint of the *shallow-jointed coral* near an inch in diameter, two inches and an half long; a piece of *white fibrous or striated*, but not knotted, the *bubbled coral*. 'Tis of an *ash-colour*, and rough-cast all over, with very small blisters or bubbles.

There are also two sorts of the *coom-coral*, wrought all over like an *honey-comb*; also some rough and porous *red coral*, and a *pumis coral* of a *grey colour*, porous and somewhat like a *pumis-stone*; also a *pounced coral*, that is *white*, and the surface prick'd full of small holes, also the *branching pounced coral*, the *steoping pounced coral*, the *russet pounced coral*, and the *warted pounced coral*.

In this repository are the *white and brown starry corals*, and the branches of the last are flat like the horns of an *elk*, and spread abroad.

There are several sorts of *fistula corals*, some like birds eyes, and one is a *crowned sort*.

There are also two sorts of *foliated or leav'd coral*. *Coral* is fished for from the beginning of *April* to the end of *July*, not in the ocean, but in the *Mediterranean-sea*; in which there are eight or nine fisheries among the rocks, no where above forty miles from land. Three upon the coast of *Sardinia*: on that of *France* two; of *Sicily*, *Catalonia*, *Corfica*, and *Majorqua*, one. Of *white coral* there is great abundance in *Brasil*. Of

of HUSBANDRY and TRADE. 61

Of the nature and generation of *coral*, it is affirmed by the honourable Mr. *Boyle*, that whilst it grows it is often found soft and succulent, and propagates its species. The Doctor also gives an account of its encrease by a spermatick juice.

There are also a great variety of *bastard-corals*.

Of *corals* are chiefly prepared the powder ground upon a *marble*, the magisterial salt, and the tincture: To good purpose in some fevers and some other cases. But the name of tincture is a meer deceit, it being in truth no more but a *liquamen* or *solution* of the magisterial salt: for those acid liquors, which are used as *menstruums* for the making of it by digestion or repeated heats do always turn red.

Thus far Dr. *Grew*, which I could not omit, though I have abbreviated him what I could: but refer the more curious to the account at large.

Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.



FRIDAY, June 26. 1696.

NUM. CCIV.

What coral was imported Anno 1694. Arts encouraged. Bastard coral and coraline. Amber, what. Some found in the earth twenty five miles from sea. Divers sorts. Where found. What good for. Counterfeit amber.

IN my last I have given some account of a great variety of *corals*. I am now to apply them.

There came in the year 1694. under the general name *coral*, from *Holland* one hundred and thirty eight pound, from *Streights* eighty two pound, from *Germany* twenty five pound, in all two hundred and ninety pound. Under the name *whole coral*, from *Holland* forty four pound. Under the name *fragments* of coral, from *Holland* nineteen pound, from the *Streights* one thousand six hundred and forty nine pound, in all one thousand six hundred sixty eight pound. Of *polish'd coral*, from *Holland* nineteen pound. Of *coral-beads*, from *Holland* twenty pound, from the *Streights* one hundred and forty pound, from *Germany* one hundred and fifty nine pound, in all three hundred and nineteen pound. Of *counterfeit coral*, from *Holland* two hundred and fifty pound. All these amount to two thousand five hundred and ninety pound; among which, I am glad to see there are but nineteen pound *polish'd*: surely we manage the rest our selves, except

of HUSBANDRY and TRADE. 63

except the three hundred nineteen pound of *beads*, the making of which we might very much encourage here, if among our childrens recreations we would also teach them some arts, they might easily learn, as, *turning*, &c. This beside the diversion would procure them (tho' sold at easy rates) money enough for their childish expences; and not only so, but inure them to the custom of getting money, and push on their minds to greater adventures. I suppose the *counterfeit coral* is used for rock-work.

There are many more *bastard-corals* and *coraline substances* in this Dr. Grew's *Museum*, to which I refer the reader.

According to our method, the next imported commodity is *amber*, which, the aforesaid Bishop *Wilkins* says, is of a strange *original*, not being properly *minerals* though usually reckoned among them, but supposed to proceed from a *liquid bitumen*.

Dr. Grew tells us there is in the *Royal Society's* repository a piece of *opacous yellow amber* half a foot long, given by *Tho. Henshaw*, Esq; found with several lesser pieces in digging of a ditch under the walls of *Rensburgh* in *Holstein*, eighteen feet under ground; which place is at least twenty five miles, both from the *Baltick* and *German* seas.

There are also several other pieces, some of a *clear yellow colour*, some *semiperspicuous*, some *opaque*, divers with *insects* in them.

In *Septalius's Museum* is one so large as to bury a frog; and *Boetius* affirms, that pieces are found sometimes as big as a man's head.

'Tis found in great quantity in *Pomerania*, and upon the coast of the *Baltick* sea. The Elector of *Brandenburgh*, sovereign of that coast,
farms

64 *A COLLECTION for Improvement*

farms it out for twenty thousand crowns yearly; also plentiful on the coasts of *Soffala*, *Mosambique*, and *Melinde*.

Amber is much commended as a specifick against the *epilepsy*.

Take yolks of eggs sixteen, gum arabick two ounces, gum of cherry-tree one ounce: dissolve them and set them in the sun for an artificial amber. Amongst the many opinions of the original of amber, our Doctor questions whether it be not a kind of hardned *petroleum*.

Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, July 3. 1696.

NUM. CCV.

Amber, what worth yearly to the Elector of Brandenburg. Price of great amber. Great quantities in the Baltick. What amber is thought to be. How much was imported, Anno 1694. Oil and salt of amber. A proposal.

IN my last I gave an account what Dr. Grew said of *amber*, now follows what I have received in a letter from my very ingenious and good friend, Mr. John Scarlet, a merchant at *Pillau* in Ducal *Prussia*, belonging to the Duke of *Brandenburgh*.

It

It is certainly a mystery to this day, whence all the amber comes, that is gathered yearly on the *Prussian* coast, which amounts to the Elector's treasury (all expences deducted) about ten thousand pound sterling yearly. By the last contract the Prince Elector made with those, who buy it of him, they are obliged not only to take all that is gathered, but also to pay for the largest sorts (being scarce so big as a fist) above two hundred and thirty pound sterling for the barrel, containing about two *English* bushels and a half.

He also says, that it is most certain that not only much is digged within two or three *Dutch* miles from the sea-shore, but also that in the sea there is an inexhaustible treasure; to attain which, he imagines (by the leave of the Duke) he knows how: but that at present I am obliged to keep as a secret.

Scroder and Mr. *Dale*, and others from him say, 'tis nothing else but a bituminous juice or rosin of the earth, well digested, and from thence cast into the sea, and there concreted: but Dr. *Hook*, a very understanding *virtuoso*, will have it a *vegetative substance*, and thinks it to be nothing else but *turpentine*: for trees that have been found under ground have had such substances found with them.

There was imported to *London* in the year 1694. from *Dantzick* one hundred and sixty two pound, and certain from *Sweden* seventy two pound, from *Germany* nine hundred and ten pound, from *Holland* twelve pound, in all one thousand one hundred and fifty nine pound, and certain. Also from *Dantzick* one hundred and six masts, and of beads from *Dantzick* thirty three pound, from *Germany* forty one pound, from *Holland* one cabinet.

66 *A COLLECTION for Improvement*

This is a commodity we cannot produce here; and I am afraid that the largest we send out again unwrought, to very little advantage, and with the small we make *oil* and *salt* of *amber*, the first of which is a meer drug. I have fifty pound of it, which I would sell very cheap; but the salt is in great request, and very valuable if good. Although by laying a high-duty upon *amber*, I am informed there is a great deal imported of this salt privately, without paying one farthing duty. As for beads, I do not hear that we make any in the kingdom, neither do we cabinets, to our shame be it spoken; I question whether there be one man in *England* knows how to work it. I once had occasion for one, and could find none save Captain *Choke*, the inventor of necklaces for breeding teeth easy, (and now he is dead, I question if there be another.)

Methinks we should take off all duties from the simple *amber*, and give all encouragement to further its *manufacture*, which I persuade my self might be very considerable, if well managed.

Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, *F. R. S.*



FRI.

FRIDAY, July 10. 1696.

NUM. CCVI.

Bezoar, *what, whence, and how much imported. Its description. The counterfeit. Gascoign's powder. Its description. Goa-stone. Its description. A cause of sweat and pain. Goa-stone good for punch. Occidental bezoar and such like, taken from oxen.*

THE next in course to *amber* is *bezoar*, of which one thousand nine hundred and sixty ounces were imported from *India*, anno 1694. 'Tis said to be taken out of the *capri-cerva* or deer-goat. Mr. Dale calls it the *bezoar-goat*, and says, 'tis an animal of *Persia* and the *East-Indies*. 'Tis a stone of divers shapes, as oval, long, flat, triangular, and what not; it has a straw, stick, stone, or something else in its middle; and I presume its shape is agreeable to the shape of the matter it encloses; the out-side is smooth and shining, of a greenish colour, something like the great olive, it has little scent; it is *capous*, or laminated like an onion, one coat upon another, and seems *contiguous*, rather than *continuous*. 'Tis of most magnitudes from an ounce and half downwards. It is scarce and generally dear: I have known it under twenty shillings, and lately it has been sold for almost five pound the ounce: for this reason several have been counterfeited and made up with powders, rosin and mucilage: but these are discover'd with a hot

F 2

needle,

68 *A COLLECTION for Improvement*

needle, or rubbing upon chalk first rubb'd on a paper; it will not look greenish, as the true *bezoar* will, but the best way is minding the coat, the colour, and breaking the stone.

With this and several other things is made the *Gascoign's powder*, which is an excellent medicine indeed, and in very great use with our *English* physicians; but this may be abused also, although those used to good may know it by the colour, which is *greenish* also, and may be known not only by looking on, but also by rubbing it wet on a chalk'd paper.

The *Goa-stone* made in *India*, and brought hither, is thought to be a such like medicine; 'tis cover'd with leaf-gold, and then varnish'd over, commonly in balls like pigeons eggs: 'tis esteem'd as an excellent medicine, only there is this difference; the *Gascoign's powder* is made in *England*, and we certainly know what it is; but *Goa-stone* we take upon trust; however 'tis generally believed to be a good medicine.

These are all excellent in a great many cases; our famous physicians seldom write a bill without some of them; particularly they are very good, where the blood wants sweetning: for they are *alkali's* which have a nature to destroy *acids*, to prove which if you mix them with some juice of lemon or vinegar, it will ferment or bubble up a while; but afterwards all the *sourness* will be gone, and by its imbibing the acid salt from the blood the ferment causes a heat, and the thick parts being gone, the rest are made thinner and more ready to transpire; and thus it is, according to my imagination, that sweat is rais'd by such medicines; and by reason they commonly ease pain, it is an argument with me that pain is caused in a great measure by such acid salts.

The

of HUSBANDRY and TRADE. 69

The *Goa-stone* is something perfum'd, and us'd greatly in *punch*, which it improves much, as say the artists in *punch-making*.

There is an *occidental bezoar* of divers colours, and bigger, and some such stones are taken out of oxen, but they are reckoned far inferior to the *Eastern bezoar*.

Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, July 17. 1696.

NUM. CCVII.

Cornelian rings, *how many entred. The stone good to stop blood. Diamonds, how many imported Anno 1694. Their use. Our glass-house fire won't melt them, except mix'd with some salts. Their value is great. Their political use. A rock of them in Gresham-College. The four chief diamond mines that are known.*

NOW I have done with the *vulgar* and *middle-priz'd* stones, I come to *precious stones*, which are called *gems* or *jewels*, and they are less or more transparent.

Among the less transparent is the *cornelian*, of which was imported *Anno 1694*, from *India* seven rings.

70 *A COLLECTION for Improvement*

'Tis very likely more were imported; but they and several other are commonly private trade, and are gotten ashore without entring.

This stone Dr. *Wilkins* reckons with the *sardius* and *blood-stone*, and others call them all one. 'Tis chiefly used in rings, although the powder is reckon'd a specifick in stopping of blood.

The next are *precious stones* more transparent, and the first is *diamond*, which is a stone colourless, most hard and bright. Of these there came *Anno* 1694. from *India* one hundred and seventeen, besides certain seven times, and certain from *America*. How many these certain are, I know not; but so they are entred at the Custom-House.

These are stones fit for greatest persons; they are the hardest known; and them that are without flaws, 'tis very difficult to break: their chief uses are for ornament, and cutting of themselves, softer stones and glass. Great art has been tried by Mr. *Martens* the jeweller in *Broad-street* to melt them, but our glass-house fires do nothing. Their values are according to magnitude and fineness. Princes with them can make great presents in small room; and subjects in despotical governments can in them keep great treasures, that their Princes can neither tax nor seize.

A diamond has the pre-eminence (says Mr. *Edmund Halley*) above all transparent substances, first in its hardness, being cut by nothing but itself. Next in its resisting fire, it being generally reputed incapable of *fusion*, unless it may be melted by the addition of some flux of salts, which yet perhaps may only serve to folder the adamantine atoms by the saline particles. But above all, in the degree of *refraction*, which is double to that of any other body, the sine of incidence being

of HUSBANDRY and TRADE. 71

ing to the fine of the refracted angle in the proportion of five to two, whereas in glass it is but as three to two.

Dr. Grew in his *Museum* tells us, there is in *Gresham-college* a rock of diamonds given by Sir *R. Moray*. They grow on a bed (about three inches broad and four in length) in chrystals sex-angularly pointed; of several sizes, from the thickness of a middling pin, to a quarter of an inch diameter, but all of them short, not very perspicuous, but a little greyish like the *calcedony*, saving one small cluster of them, tintured yellowish. They cut glass very deep and easily.

The principal diamond mines now known are four; that of *Raolconda* in the kingdom of *Visapour*, discovered two hundred years since. Here the diamonds lie in sandy veins in the rocks of all the clearest and the whitest water. They pound and wash the vein for the diamonds, just as we do some of our *ores* for the metal. A second called the *Gany*, about seven days journey from *Golconda*, found out one hundred years since: here they dig not above fourteen feet deep. Sometimes above sixty thousand men, women and children at work. It affords the largest diamonds, but not clear; one sometimes above forty carats, or one third of an ounce. Here was one found of nine hundred carats, or seven ounces and a half. A third, that of the *Govel*, a river in the kingdom of *Bengala*. The diamonds are found in the sand of the river, for the space of fifty leagues. From hence come those fair-pointed stones, called *natural points*, but not great.

Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

F 4

FRI-

FRIDAY, July 24. 1696. NUM. CCVIII.

A diamond-mine in Borneo. How diamonds are figured. True diamonds unite foil closely. With what foil is made. The difference between the grain and vein of a diamond. How diamonds are sp'it. Bastard diamonds, the Cornish are better than Bristol stones. We had formerly a great trade in diamonds. A proposal how to regain it.

IN my last I gave an account of three of the chief *diamond-mines*. The fourth is that of *Succadan* a river in *Borneo*. But all come thence by stealth. How the *Indians* prove, work, and sell their stones, see in *Tavernier*.

Rough diamonds are often naturally figured into triangular plains. A mark to know a right stone by as well as hardness. Many also of the best are pointed with six angles, somewith eight, and some tabulated or plain and square. *Diamonds* receive no hurt; but are rather mended by fire. Some take up straws as *amber*, and other *electrical* bodies. *Mr. Boyle* had one, with a little friction, would attract vigorously. Another which by luke-warm water he could make shine in the dark.

'Tis the property of all true *diamonds* to unite the foil closely and equally to itself, and thereby better augment its lustre than any other gem. The foil is a mixture of *masstick* and burnt *ivory*:
the

of HUSBANDRY and TRADE. 73

the latter being one of the blackest of colours, used by painters for velvet, the pupil of the eye, &c.

The water of those drawn from the ground commonly partakes of the colour of that soil; and some are found as yellow as a *topaz*.

The difference between the grain and vein of a *diamond* is, the former furthers, and the latter being so insuperably hard hinders, its splitting, although sometimes a vein is nothing but a cross grain.

When our *European* jewellers split one, they take a very small iron wire, and having daub'd it with oil and powder of *diamonds*, draw it upon the *diamond* by a tool to and fro like a saw, so long as is needful for that purpose.

The *bastard-diamond*, *pseudo-adamas*, now remaining as it was found, bred in a *musculites*, a stone like a *muscle-shell*. 'Tis angular, pointed and very clear; and cuts glass with great ease and depth.

Of our *bastard-diamonds* here in *England* the *Cornish* are best, much better than those on *St. Vincent's rock* near *Bristol*.

In the reign of King *Charles* the second, we had a mighty trade for *diamonds* from the *East-Indies*: 'twas generally talk'd of as the chiefest in *Europe*, and they amounted to several hundred thousand pounds each year; but since that company has been discouraged, this trade has greatly sunk; and by consequence the workers of them must cease too, the more to our dis-repute; but every dog has his day, and every nation its fate: had we continued growing as we then grew, we had by this time been a monster; and it's probable most of our neighbours would have been afraid of us. But however, the best way to regain that trade,

74 A COLLECTION for Improvement

is to have them in fashion in a high degree. This will incite an industry to procure them, and much encrease our trade at home to get materials to purchase them with, or to buy money that shall do it. When there is no goal to run to, the racers are sluggish. And so much for diamonds.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, July 31. 1696.

NUM. CCIX.

What hiacynths imported Anno 1694.

Their description. Earthy concretions dissolvable what. How much salt was imported. How many ships it would employ.

A guess at the quantity of salt spent, and the number of ships might be employed.

The advantages of making our own salt.

THE next sort of precious stone to diamond, that was imported, was *hiacynths*; and of them of fragments from Germany twenty eight pound, from Holland one pound, in all twenty nine pound.

This, Dr. Wilkins says, is one of the coloured precious stones, of the purple or violaceous sort, more inclining to yellow.

Mr. Dale says, 'tis a pellucid gem of a yellow red, or saffron-colour, imitating flames of fire. It hath a power of corroborating the heart, and

of HUSBANDRY and TRADE. 71

defending from the plague; and it is a singular specifick against cramps and convulsions; and *Scroder* says, 'tis adulterated with glass of lead; but 'tis easily distinguished from the true gem, by its weight and hardness.

The next sort of stone *Bishop Wilkins* reckons to be *earthy concretions* dissolvable, which he reckons to be *salt, nitre, alum, sal gemme, vitriol, tartan alkali, urinous, salt, sal ammoniac, chrysocolle* or *beran, sulphur, bitumen, naphtha, ambergris.*

The first of these is *salt*, of which was imported in the year 1694 from *Portugal* wey forty five, from *Spain* wey seventeen thousand one hundred and twenty six, from the *Streights* wey five, in all wey seventeen thousand one hundred and seventy six. Each wey is reckon'd forty bushels, which at half a hundred to a bushel is just a tun: so that here was imported seventeen thousand one hundred seventy six tun, which would employ at one hundred tun each one hundred and seventy one ships, at two hundred tun each eighty five ships and a half, at three hundred tun each fifty seven ships. A great trade indeed! But what's all this to the kingdom? This only comes to *London*.

But if all the salt we use was to be brought in from abroad, and we used in a year but four bushels to a family, it would amount to one hundred and thirty thousand tun, and employ one thousand three hundred ships at one hundred tun each, or six hundred and fifty ships at two hundred tun each, or four hundred and thirty three ships at three hundred tun each, supposing these or the former go but one voyage in a year; and this, I suppose, is no extravagant calculation: I rather think we use more; for although
many

76 A COLLECTION for Improvement

many poor families use not so much, yet the dairies for butter and cheese use a great deal, and all that preserve *pork, bacon or beef*, do the like. The navy uses abundance; and there is not a house but uses some. Our salted provisions for foreign markets are great; and 'tis no small quantity that is wasted: but we need not go so far for our salt with charge, danger, and employment of many foreigners; we have enough at home to serve our turns; and there from first to last we employ none but our own people; and ships and carts to fetch coals, and carry the salt are very numerous.

I intend to carry on the history of salt; therefore if any that are concerned in salt-mines or works would have me say any thing about them, they must let me know.

Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.



FRIDAY, August, 7. 1696. NUM. CCX.

Different sort of salt. Description of salt.
Sal gem prov'd to be the same with common salt. Salt ferments with oil of vitriol. Some conjectures about the saltiness of the sea. The Euxine sea runs always outward, and is esteem'd salter than any.

IN my last I gave an account of the quantity of salt imported to London 1694, and promis'd a farther account of salt.

In my third volume I have told you from Dr. Willis that salt is known by divers names: for besides fluid, fixed, volatile, 'tis term'd marine, aluminous, nitrous, vitriolick, armoniack, or of some other kind, and perhaps there are as many different sorts of salt, as salt will chrySTALLIZE into different forms.

Dr. Wilkins reckons the imported salt I am treating of to be a factitious substance, having some analogy, to be mineral and dissolvable by water, not inflammable, being a more simple kind from sea water, and the most necessary condiment for meat.

Most authors make a difference between common salt made from brine, the salt from the sea, and Sal Gem, or Rock-Salt; but Mr. Edmund Halley thinks them all one, and he proves it thus. He made before the Royal Society a brine with common salt, and fully satiated it so that a
 good

78 *A COLLECTION for Improvement*

good quantity sunk to the bottom in form of *white salt*; then he hung in this brine for many hours a piece of *Sal Gem* or *Rock-salt*, but there would not one grain of it dissolve; but when other sorts of *salt* were put to it they dissolv'd presently: from whence he concludes that the *Sal Gem* and *common salt* were of the same species of matter.

Dr. *Nehemiah Grew* in his anatomy of plants, &c. p. 246, says, *common salt* stirs neither with spirit of *salt*, nor with spirit of *nitre*, nor with *aqua fortis*; but with *oil of vitriol* it makes a great effervescence, with noise and steams.

The same Dr. in p. 234, thinks *sea-salt* nothing else but that of *animals* and *vegetables* carried thither and freed from their other parts, which he endeavours to prove by an experiment there, and p. 263, and 266. and his last cut has the figures of various salts, the sincerity of which I doubt not; yet, under favour, considering Mr. *Halley's* experiment above, and that the major part of *sea salt* is acid, and the major part of *animal* and *vegetable salts* are *alkalous*, I see no reason why we may not think the *saltiness* of the *sea* to proceed also in a great measure from the washing down of the *fossile* or *rock-salts*, either from thence or after they've been brought into use by mankind; but this I give only as my conjecture; but find Dr. *Plot* in his history of *Staffordshire*, p. 87, to be of the same mind; and he is confirm'd by the authority of *Pliny* and *du Hamel*, p. 88.

I am inform'd that the *Euxine* or *Black Sea* runs always out by *Constantinople*, with a water esteem'd *salter* than that of the other parts of the *sea*; and that *sea*, receiving many and great fresh rivers, ought to be diluted and grow fresh, unless

of HUSBANDRY and TRADE. 79

unless the *saltness* were perpetually supply'd by the dissolution of beds of *rock-salt* in the sides and bottom thereof, such as are found in *Poland*, *Transylvania*, and other countries bordering thereon.

Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, *August* 14. 1696. NUM. CCXI.

The sea water has three in the hundred salt. Excellent salt made at Preston in Staffordshire. The difference of proportion of salt from the brines of Weston, Upper-wich, Middle-wich, North-wich and Nampt-wich. How long the watry part of brine is evaporating. The bigness of pans to boil salt. How much coal spent to a drawing. Sand in brine, how much. How clarified. How salt is corned.

IN my last, beside other things, I gave some conjectures at the reason of the *saltness* of the sea, which, I am inform'd, is about three in the hundred. I now come to the manner of making salt; and Dr. Robert Plott, in his history of *Staffordshire*, says, there is some made in the parish of *Weston*, where is made perhaps as good white salt as any in *England*, tho' not to so great advantage: for it yields but a ninth part of salt
(whereas

80 *A COLLECTION for Improvement*

(whereas at *Up-wich* and *Middle-wich* it yields a fourth; and at *North-wich* and *Nampt-wich* a sixth) but with the advantage of the brine left in a former pan fifteen hogheads of brine makes nine strike of salt, which is sixteen hours in evaporating away.

The pit from whence this brine is pump'd, is nine yards deep and two yards square; what comes from the bottom is much the stronger in *saltness* and *stink*, and of a clearer complexion; and the pans wherein they boil it are three made of forged iron, two yards three quarters long and one yard three quarters broad, and their fuel pit-coal, whereof when their pans are all kept going, they spend two tuns to a *drawing*. During the boiling the *salt* is cleared from *sand*, of which there is some (at least will be after it has exhaled for some time) in all brines whatever, which is thrown off towards the corners of it, where are plac'd small square iron pans to receive it; this brine, which is evaporating so long, yielding ordinarily from the five fillings ten pans of *sand*, each weighing ten pounds, in all one hundred of *sand*, which is above one fourth of as much sand as salt, allowing a bushel of salt to weigh about fifty pounds. About three hours before the evaporation is finish'd, that is, before they begin to draw (at the fifth filling) they clarify the brine with the *white* of one egg, which being broken into a bucket, and mix'd both with cold and some of the hot brine, is by the motion of the hand brought into a *lather*, and gently sprinkled all over the pan; whereupon there presently appears a *scum* that thickens by degrees, as the impurities rise, which thus catch'd and detained, he supposes by the viscosity of the white of the egg before the
brine

of HUSBANDRY and TRADE. 81

brine boils again, is drawn over the side of the pan, with a thin oblong square board, fix'd to a staff or handle call'd a *loot* or *lute*.

The scum taken off, they boil it again gently till it begin to *corne*, which to have to desire, if they intend a large *corne*, and have but little time to let it *corne* by a gentle fire of it self, they put into it about a quart of the strongest and stalest *ale* they can get, which *cornes* it greater or smaller according to the degree of *staleness*: or if they would have it finer than it usually *cornes* of it self, they either draw it with a *quick* fire, which breaks the *cornes* small, or sprinkle the surface of the *brine* with fine wheat-flour, which makes the salt almost as fine as the sand which comes from it; which being the finest and whitest that ever he saw, he thinks it may be of admirable use in making *glass*. But during the time of its *corning*, they generally *slacken* their *fire*, supplying the furnace now, rather with the cinder of the coal (the smaller sort sifted from the ashes) than the coal it self; this giving the *brine* a gentle heat without flame, and *corning* it better than a forcible fire, which breaks it small. Quickly after it has spent some time in *corning*, they begin to draw, *i. e.* to take the *corned salt* from the rest of the *brine*, with their *loot* or *lute*, which they put into *wicker baskets* they call *barrows*, made in a *conical* form, and set the bottom upwards, each containing a bushel; through these being set in the *leach-troughs*, the *salt* drains it self dry in three hours, which *draining* they call their *leach-brine*, and choicely preserve it to be boil'd again, it being stronger *brine* than any in the *pit*.

Next Friday expect more from

Yours,

JOHN HOUGHTON, F. R. S.

VOL. II.

G

 FRIDAY, *August* 12. 1696. NUM. CCXII.

The draught or management of the salt. 'Tis here clarify'd with whites of eggs. Blood gives salt an ill colour and savour. 'Tis more clear'd from sand than Cheshire or Worcestershire salt. Several brines in Staffordshire. Mr. Cragg's account of salt. In Spain, Portugal, and France, salt is made by the heat of the sun. The French salt greatly makes salt upon salt. The Scotch and English is made by boyling, and the best care makes best salt. How salt upon salt is made.

IN my last I gave you a great process of making salt in *Staffordshire*; the rest follows.

The draught of the *corned-salt* mention'd in my last continues here for about six hours, and is perform'd gradually, the salt-workers getting first about two bushels or barrows full; then by a gentle fire they *corne* it again in half an hour, for the three first pair of barrows; but afterwards not under an hour, the *brine* being then thinner, and the *pan* cooler. They leave some brine towards the next filling, which with the addition of the *leach-brine*, heightens the weak liquor, and much advances and facilitates the following operations. The *barrows* being fully drained, are remov'd into the hot-house, behind the *Saltern* to dry, and are set over the *brick-conveyance* of the flame, from under the

4 pans

pans to the tunnel of the chimney (which passage for that purpose is made six or seven yards long) where after they have continu'd for twenty four hours, the salt will become so dry that it is fit for carriage or publick sale.

This is the tedious process of making *salt* in *Staffordshire*, which, tho' much more chargeable than in *Worcestershire* or *Cheshire*, where they spend not ordinarily above half the *time* or *fire* (nor need they above a quarter) of what the great quantity of brine, they must use here, necessarily requires for its evaporation; yet its being always clarified with eggs and not with bullocks blood, as it is most commonly in *Cheshire*, which gives the salt an ill colour and flavour; and its being better clear'd from sand by long *boiling* than either *Cheshire* or *Worcestershire* salts, have given it such a reputation amongst considering men, that the undertaker is encouraged still to prosecute the *work*.

The Doctor has proposed some way how to improve this *salt-work*, by *claying*, *matting* and *sunning* it, whereby much coals might be saved; but whether they think fit to take his advice, or the play would be worth the candle, I know not.

Besides this salt in *Staffordshire* there are other brines, but they being weak and of no great concernment, I refer the reader to the Doctor himself in page 95, &c.

In Number 2 of my 2d 4^{to} Volume p. 44, &c. there is a letter from Mr. Cragg, sometime husband to the royal fishery, giving an account of *salt*, of *Spain*, *Portugal*, *France*, *England*, *Scotland*, and *salt* upon *salt*.

The two first are made by the sun's heat and *kern*, with some filth of the sea into lumps of

84 *A COLLECTION for Improvement*

all degrees, to the bigness of a hand, (but the *English* and *Dutch* seldom use it thus,) and then mix'd with smaller *salt*.

The *French* has a less kern, but more filth. It is greatly used to make *salt* upon *salt*.

Scotch and *English* are made by boiling, and where is the best care of separating the *bittern* and enlarging the *kern*, there 'tis best.

Salt upon salt is *sun-made* clarified with salt-water.

But his chief aim is to speak of *port-sea-salt*, of which

Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, *August* 28. 1696. NUM. CCXIII.

Port-sea-salt *commended by divers examples.*

How much salt vended yearly to the Northern Kingdoms. Where are the chief brine-pits. The qualities of the best salt. North-wich best situated. What boiling required to make salt.

Port-sea-salt, mentioned in my last, Mr. Cragg commends highly, but refers to Mr. Collins for its manner of making, and tells several experiments of it; as of the company's *Island-cod*, that sold for forty shillings the thousand before others: of *herrings*, that kept well two years:

of HUSBANDRY and TRADE. 85

years: of *pickled porkets* that were excellent: of *brisket* and *other beef*; some whereof, by being in the pickle twenty days, were hung up afterwards for the whole summer, and yet continued rare: of a *leg of mutton*, on a wager, that, in *dog-days*, lay in brine but one night, and has hung up (maugre the hot weather) ten days, yet continued good, and so fresh as to eat salt with it, and doubted not but *venison* might be sent so from any one part of the Kingdom to another. This is the epitome of what he there says more at large.

Now I must give you some larger account from a book of *salt and fishery*, written *anno* 1682. by my very good friend Mr. *John Collins*, a fellow of the *Royal Society*; where, in the epistle to the reader, he tells of a paper belonging to *William Lord Brereton*, giving an account that there were vended yearly to the *Northern Kingdoms* two hundred seventy six thousand barrels of salt, of four bushels each, which is twenty seven thousand six hundred whey, or one million one hundred and four thousand bushels: which, considering a wey to be a tun, makes for one voyage the year employment for two hundred seventy six ships of one hundred tun each, or one hundred thirty eight ships of two hundred tun each, or ninety two ships of three hundred tun each: and this account was taken by Mr. *Bedal* a merchant in one thousand six hundred and seventy three.

In the book it self he says that the chief brine-pits are in *Cheshire* and *Worcestershire*, and that the chief in *Cheshire* are at *North-wich*, *Middle-wich*, *Nampt-wich*; of which *North-wich* excels.

36 *A COLLECTION for Improvement*

There is in the town one pit, and five without, and all afford great plenty of excellent brine, of which is made *salt, pure, small, or big kernal, heavy, hard, dry*, that loseth little in bulk, if well kild or press'd into the bag, which are the qualities of the best *salt*, and is there sold at six pence the bushel.

This is more conveniently situated than the rest, being within five or six miles of *Fratfome Bridge*, where it is laden for *Ireland*, and a river comes through the town, that might be made navigable.

At *Middle-wich* are seven pits or brine sheaths, which yield great plenty of most rich brine.

At *Nampt-wich* is one within the town, and two without; and are sufficient to serve the fourth part of the nation, altho' 'tis weaker than the other *Wiches*, in which some, he is inform'd, will turn to salt in an hour's boiling, whereas at *Nampt-wich* the pans are twice or thrice fill'd, and boiled down, and the Lord *Brereton* made leaden coolers to put the salt in, as it came out of the pans, where it would dry, harden and become big grained.

Next *Friday* expect more from

Yours &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, September 4. 1696. NUM. CCXIV.

An estimate of the strength of brine, by the coals spent at the three Wiches. The number of pans. Quantity of salt made and coals spent there, with the cost of every thing. The springs are from salt rocks. More salt may be made in England, than can be spent in our King's dominions. The proportions of salt in sea-water and Cheshire brine. How salt is boiled at Nampt-wich, and in what time. How salt is clarified, and why. Accidental differences. At Up-wich, the fourth part of the spring is salt. The dimensions of leaden pans. Full improvement of wood-land. Improvement of evaporation. Rosin, its use.

MR. Collins has given an estimate of the strength of *brine*, in the three *Wiches*, mentioned in my last; by comparing the quantities of *salt* there made with the quantities of *coals* spent in one week, with a table shewing the names of the *salt* works and owners; the number of *pans*; how many bushels of salt at each, being in all twenty thousand seven hundred and fourteen; how many loads of coals spent at each, being in all three thousand three hundred and thirty six; the price of coals at each, being in all one hundred and

88 *A COLLECTION for Improvement*

seventy eight pound eighteen shillings. The other costs twenty seven pound fifteen shillings and four pence. The pans mentioned are seventy two, beside, at three several works they may be at pleasure.

Several of these springs are known to come from salt rocks.

'Tis Mr. *Collins's* opinion, that in *Cheshire* and *Worcestershire*, with skill, cost and labour, there may be more salt made, than can be spent in the King's dominions.

He says, from *Philosophical Transactions* Numb. 142. that five or six gallons of sea-water, yielded not so much salt as one of *Cheshire* brine; if so, it follows, that if sea-water yieldeth three per cent. *Cheshire* brine yieldeth eighteen per cent. and the use of coals must be proportionable.

The same *Transaction* gives an account that at *Nampt-wich* they boil it in iron pans, about three foot square, and six inches deep: their fires are made of *Staffordshire* pit-coals, and one of their small pans is boiled in two hours.

To clarify and raise the scum they use calves, cows, and sheeps blood, which is said to give the salt an ill favour. I presume any blood will do, and it is by its viscosity (clamminess) like whites of eggs, which makes the filth stick to it, and get together in a scum, and the blood is used only for cheapness sake.

All that he says further in comparison of salts I take to be but accidental differences, according as the grain is larger or smaller, or more or less free from sand or other mixtures. And so I shall pass on to *Worcestershire* salt, and say no more from Mr. *Collins* than what the necessity of my history requires.

From

of HUSBANDRY and TRADE. 89

From the former *transfaction*, he gives an account that about *Droyt-wich*, within four miles of *Worcester*, are many *salt-springs*, and from one in the great pit at *Up-wich* is made four hundred and fifty bushels of *salt* in every twenty four hours; 'tis so strong that the fourth part is *salt*.

They use *leaden pans* five foot and a half long, and three foot wide.

Their fuel was formerly all wood, but since the iron works in *Dean* forest have destroyed that, they now use pit coals, brought thirteen or fourteen miles.

I doubt not but that *corn* or *grafs* grows where the wood did, and that from whence they fetch *coals*, they carry salt and other things, which must needs make an increase of employment, and wealth; neither do I hear of a decrease of iron-workers in *England*.

He tells, from Mr. *Boyle*, of often straining brine through *mats*, and of an engine to cast it much in the air, in order to evaporate the watery parts, and thereby save firing; and also of new furnaces for quick boiling, so that four or five times as much *copperas*, *salt*, *alom*, &c. may be boiled at the same charge as formerly.

He ingeniously notes, that an over strong brine allows not time enough in boiling, to separate the sand and other ill qualities; but why they should put to their strong brine rosin, except it be by its clamminess to gather the filth, and why that should make the salt small grain'd, truly, I don't yet see.

Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRI-

FRIDAY, September 11. 1696. NUM. CCXV.

How to raise scum in brine-pans. Salt-springs cool and never freeze. Salt will dry quickly. How salt weighs. Why some salt seasons sooner than others. White salt makes best colour. Clod-salt, its use. Salt loaves will keep. How salt came to be made at Shields: their pans described. How filled and boiled. Salt may be plentiful there: 'tis improved there. Difference in salts. New-Castle-salt, good for most purposes. Salt upon sand. In Varro's time no vine, olive, apple, sea nor fossile salt on the Rhine.

IN most salt-works, beside blood, they use to clarify it, and raise the *scum* of the brine, by putting a fourth part of the white of an egg into a gallon or two of *brine*, which will lather like soap, a small quantity of which, put into each pan, raiseth the *scum*.

The salt-springs are very cool at the bottom, and not to be endured by men above half an hour, though they be well warmed by much strong-water; however, it never freezeth.

To prove this salt better than others, he says, 'twill dry in four hours, and keep so three quarters of a year, and is not so apt to dissolve as salt upon salt. That none is whiter and freer from dross, and a *Winchester* bushel weighs half an

of HUSBANDRY and TRADE. 91

an hundred. That in the same quantity it makes meat *salter* than *French-salt*: but I conclude this must be from its being freer from dross, and so there is more salt, and its having a smaller grain, makes it dissolve sooner. It hath preserved flesh to *Jamaica*. Herrings have been salted herewith, and brought from *Ireland*, and have been whiter and better tasted than with bay-salt. I doubt not this, because the salt was more white. It is ordinary to salt beef but once to keep a year. 'Tis common with all barrelled beef to do so.

They have a sort called *clod-salt*, digged from the bottom of the pans with a picker, being the strongest and most used for bacon and neat's-tongues; it makes the bacon redder than other salt, and makes the fat eat firm: some put it into their rennet-pots, and say it's best for cheese. This is accounted too strong for beef: perhaps because 'tis a large grain, and penetrates by degrees, which is equivalent to an often salting. With the finest white salt, they make loaves like sugar-loaves, which will keep dry without fire, but at *Nampt-wich* it is otherwise, I presume from a different management; for Mr. Martin, an experienc'd man in salt, says, that whatever may be said of *Worcestershire* salt, the like may be said of *Cheshire*.

Now I come to salt made by boiling of seawater, and Mr. Collins says, the want of brine-springs, near the Eastern-coast, and dearness of foreign salt, necessitated the making salt at *Shields*, and in *Durham* and *Northumberland*. The pans there used are made of wrought iron, of eighteen or nineteen foot long, twelve foot broad and fourteen inches deep; and boiled with the worst of coals. At spring-tide they let the seawater into ponds, called *sumps*, from whence 'tis
pumped

92 *A COLLECTION for Improvement*

pumpt into their pans, which are six or seven times filled, and half or more every time boiled away, before it becomes *salt*.

When great freshes come into *Tyne*, they take no liquor, neither need they, for they make as much salt in seven months, as they can sell in twelve.

Of late they boil it better, and make it harder, for this salt hath had a bad repute, by being moist and apt to run to water.

The housewives find a great difference in salt, and the price infers the like between *Spanish*, *French* and *Portugal* salt. *I suppose still from its different form or claritude.*

Of *New-Castle-salt*, the sum is, that with good care 'twill serve for most purposes.

Salt upon salt is sun-made salt, boiled up with salt-water, and cleared from dirt, sand, and bittern, and this Mr. *Collins* grants to be good for all intents and purposes.

Salt upon sand is only *flat-water-sand*, wash'd and boiled to salt, made by them that know not how to do better, for folk have been so ignorant, that in *Varro's* Time, on the *Rhine*, was neither *vine*, *olive*, *apple*, *sea* nor *fossile-salt*, but they us'd salt of wood-ashes.

Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRI-

FRIDAY, September 25. 1696. NUM. CCXVII.

A preface. Jerbo where, described: the price of its salt. Where salt may be had easily. How beef is salted at midsummer at Smyrna. Several affirmations from Mr. Collins, with my notes.

IN my first volume is the nature of *earth*, *water*, *air*, and *fire* with their effects and reason of many of their operations: in my second, *natural history* with the *taxes*, number of *acres*, *houses*. &c. in each county of *England*, with notes, particularly of *Yorkshire* and *Derbyshire*. In my third the doctrine of *fermentation*, history of *cyder* and *clay*: In my fourth, a continuation of *clay* and its uses I could learn, with the history of *wheat*. In my fifth the history of *joint-stocks* and *kine*. In my sixth, I went on about *kine*, and have shewn the use and manufacture of most parts: also in order to *nutrition*, I have shewn the circulation of the *blood*, with some reasons why it rises from low to high parts; and also the manner how bones and other parts grow: in my seventh I have carried on the history of *kine* in discourses upon *blood*, *butter*, *cheese*, *cows*, *cream*, *dung*, *milk*, *urine*, *whey*, and several particulars: in my eighth I have given an account of all the ships that came from abroad to the port of *London*, from *New-Year's-Day*, 1694. to *New-Year's-Day*, 1695. with the number from each Prince's territories: also of all the goods imported that year, and mention'd

in the bills of entry, with the quantities imported from each place and all together. Upon these I have made some notes natural and political, as the advantage of a coalition with *Scotland*, the true case of a free trade, a regulated company, and a joint-stock, with a method for mending the roads, &c. In my ninth, histories of imported *stone, glass, salt*, a farther account of roads, &c. striving to make it the best account of trade, upon the best and most sure foot that ever has been yet published, and I could hear of: in this I shall go on to shew the advantages to be made of imported goods: and all this I will apply for the benefit of my country; not doubting but it may be made the richest and happiest the sun sees.

Now I take an account of salt from *Ferbo*, which is a place in *Barbary*, thirty leagues Westward of *Tripoli*, where much salt is made by the *sun*, on a plain of red sand. The sea (which here ebbs and flows but about a foot) making its way through the sea sandy banks, into the plain aforesaid. This is sold by the *Bassas*, delivered on board for about two dollars the tun, and it is of so strong a grain that it will hardly dissolve in fresh water.

Where the sun shines hot, and the tides vary but little, 'tis easy to have salt enough, as they have in many places of the *Streights*.

At *Smyrna* they salt beef well at midsummer, in the following manner.

One day the ox is killed, and the next day cut into pieces, and salted with salt, beat very small, then 'tis pressed into a cask, with sprinklings of salt between each lay, and so it stands forty eight hours; when the bloody brine is poured off, and the meat washed with a brine boiled
so

of HUSBANDRY and TRADE. 95

so high that 'twill dissolve no more salt, and then 'tis salted and pack'd as before, and the cask filled up with the brine, and it keeps the meat well.

Mr. Collins's observations hereon are, 1. That meat may be thus preserved from stinking a year or more, but affirms that such salt, being encumbered with bitter, will impair it in size, gravey and goodness till it rots.

The fact must shew this.

2. The bloody brine, by boiling and scumming, might have been good again.

3. Meat, in hot countries, hath been cur'd with hot salt and brine.

All salt, being dried, will imbibe moisture more than other, and by consequence will draw the blood more from the beef. But Mr. Collins says, the Smyrna beef must be cold before salted, and whether this new heat will not put it too much in a ferment, or whether the salt added to it is sufficient to stop its ferment, is to be enquired into especially since, he says,

4. 'Tis thought the sinking the casks in water will cool the meat and hinder the ferment.

Next Friday expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.



FRI-

FRIDAY, October 2. 1696. NUM. CCXVIII.

Many places yield sun-made salt, especially one of Cape Verde islands, which is describ'd; with the manner of making their salt, and at Lemmington. The ground for salt work described, and other necessities.

MANY islands in the *Atlantick* and *American* ocean yield sun-made salt plentifully, as the *Tortudos*, the isle of *May*, one of the islands of *Cape Verde*: here whole fleets of *New-found-land-men*, and *New-Englanders* use yearly to lade: it lies in the North latitude, of about fifteen degrees; 'tis peopled with *Portuguezes* and *Negroes*; 'tis of an oval form, eight miles long, and stor'd with beef, hogs, asses, &c.

The salt there is thus made. In the rains (or that winter they have) the wind veers about more southwardly, and the sea swells higher, and makes its passage through the banks (as at *Jerbo*) into a shallow lake, of about three miles in length, and in some places, about half a mile in breadth, and covers a large plain of sand, where in summer, when the sea is lower, it crusts or kerns into salt, and cakes into large pieces, where 'tis laid up in heaps, and conveyed by asses, or otherwise to the water-side, and then shipped. It costs but little, because it may be had at other places. There is no good harbour, but

but ships may ride near in shallow or deep water.

Salt made from brine raised by the sun, &c. is made at *Lemington*, in the *New-forest* of *Hants*, about three miles North-East from *Portsmouth*, in an island called *Port-sea*, from whence the salt hath its denomination.

The place where such salt is made is called a *salt-work*, and in it is to be considered, *first*, The *quality* and *situation* of the ground. *Secondly*, The *banking* or recovering the same. *Thirdly*, The *making* of brine-pans, and in them brine by the sun's exhalation, with the manner of doing thereof. *Fourthly*, A discourse of *boiling-houses*, *grates*, *iron-pans*, and the art of *boiling* the brine into salt.

First, Of the *quality* and *situation* of the ground for the most convenience.

The ground ought to be a *sea-mud*, *ooze* or *fleeck*, over-flowed, if it may be, at the lowest spring-tide three foot, then the highest will be sometimes twelve or thirteen foot.

The reason of such overflowing is, that there may be made feeding ponds with walls of earth, to keep sea-liquor in of any dimensions, two foot in height, one above another, so that the lowest may be filled by a little sluice in the bank, at the lowest spring-tide, where this, which is called stay-liquor, will improve by the sun and wind before it be transmitted into the shallow brine-pits, on lower ground. These ponds are furnished with *mulletts*, *plaife*, *flounders*, *eels*, &c. from the sea, where they increase incredibly, and exceed, in goodness and largeness, fresh river flounders and eels; and if convenient, there may be oyster-pits.

98 *A COLLECTION for Improvement*

Secondly, The ground must be strong *sea-mud*, like clay, that will retain liquor. And is not *sand, gravel, chalk* or *moor*, 'tis probably, fit and more proper than clay, being there more difficult to be wrought, and more apt to crack?

Thirdly, This mud ought to be eight, or more, feet deep, for making of ponds called cisterns, to keep brine in, without soaking away, after it comes from those pans called *sun-pans*, where it is made strong, and transferred into these, to grow more mature or mellow with age. Here the brine may be impaired with rain-water, but that swims uppermost, and the brine may be pumped from the bottom, if the bottom of the pump be fastned into a basket.

If one of these be covered with a tiled roof, 'tis called a brine-house, to retain store for winter boiling; and tiles are better than thatch, because its straws will fall into and discolour the liquor; the sides, and ends of the brine-house ought to be posts of timber, with hirdles behind, the ground being such as will not imbibe the liquor.

If the ground do not admit such depth, cisterns must be made above ground, into which the brine must be pumped or laved, which the workmen, in wet weather, will decline, to the loss of much brine.

The brine in the tiled brine-houses freeze not, but in the uncovered cisterns, the rhyme or fresh at the surface will freeze, which ought to be removed.

Note, I see not how the sun and wind should improve any otherwise, but as they evaporate the fresh parts of the brine.

I cannot

of HUSBANDRY and TRADE. 99

I cannot see what he means by maturity of mellowness, but as it grows nearer salt by evaporation of the freshest parts.

Next *Friday* expect an account of the situation from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, October 9. 1696. NUM. CCXIX.

The best situation for a salt-work. Where salt-works to be wished for. A way to make banks and mend roads. How to make salt-earth good land for the husbandman.

THE situation ought to be where there is most sun-shine, and the wind has freest access, near a coal-mine or good turf, however, not far from such place, where coals may be landed, and *salt* exported.

If ground might be had to wish, it should be a rising ground, with a channel in the middle: then with banks three parts round, high and strong enough to keep out the highest tides; both from sea and channel may ponds be made with low banks, and tho' the water, by sluices, be let in from the channel, and out from the highest to the lowest at pleasure, and be the easiest charge: if it be in a salt-water river, land-lock'd, 'twill be much the better, for lesser banks will serve, and they'll endure better.

100 A COLLECTION for Improvement

Near the channel, in the middle, may be made a key, whereon to land or ship goods, athwart which Mr. *Collins* advises a sluice with strong gates, whose hinges open sea-wards, to carry off freshes, and to keep sea-water out; and other gates may be made towards the land, to draw up windlisses.

I do not see that the sluice need be any where but at the uppermost pond, except it be to let in vessels, or to supply oftner than high tides.

If it be objected, that these qualifications seem difficult.

He answers, 1. Places enough may be found by encouragement.

2. It may be there are but few more necessary, viz. one at *Hamosfe* water, near *Plymouth*, which is thought a proper place, and some think the like of *Falmouth*.

If any be desired Northward, it may be at *Farrow-Slyke*, a little within the mouth of the river *Tyne*, by *New-Castle*, to the incredible advantage of a Northern fishery for *salmon*, *cod* and *herrings*.

Banking and recovering the ground is performed by aid of *Gin-boats*, to drive into the mud rows of trees, and posts sharpned at the lower end to shape out a walk.

These trees to be bound together long and broadways, like the ribs of a ship, with *flitterns*, or pieces of oak, or cross bars; and after good store of stones have been thrown into the middle, and parts adjacent to the channel, where these trees ought to be thickest and longest, the same to be boarded up, and the whole to be filled, when it shall seem meet, with stones, gravel, clay, &c. which will force the mud out on each side, and beget a declivity, which sea-ward may

of HUSBANDRY and TRADE. 101

be hardned with gravel to become a narrow walk, whercon to stand to drive in stakes, whereto to fix hurdles or hedges, which will be filled with sea-weeds and much defend the bank from being washed down by the waves.

After the same manner roads may be mended.

After a summer or two the recovered mud will be dry, with cracks, which must be filled with earth, and reduced to feeding ponds and levels for brine-pans.

This mud will make excellent bricks. What's designed for tillage and pasture must be deep plowed and harrow'd, that rain-water may wash the salt out; or it may be cured with *lime* or *marl*, which makes it admirably fertile, and a good compost to improve barren land. *Vid. Philosophical Transactions*, Numb. 58. p. 179.

Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.



H 3

FRI-

 FRIDAY, October 16. 1696. NUM. CCXXI.

Could we supply our selves with salt, 'twould be great advantage. Salt fertilizes. Sea-sand that is good for land is most shells. Brine prevents smut. Brackish waters best for long voyages. Offensive springs are purified by salt. Salt of dung differs from fossile or marine. Manner of making brine-pans, &c. Articles of Dutch salt. We spend sixty thousand pound the year in foreign salt. Port-sea-salt commended. Weight of several salts.

IF this kingdom should supply itself with salt, 'twould be a business of great importance, I hope this history will be useful to it, and I make all the haste that ever I can.

Mr. *Collins* gives divers instances of fertilizing land by salt, tho' antiently some cities were curs'd by sowing of salt. I presume it may be so dried as to imbibe other matters, and so make it fertile; but the *sea-sand*, by which the Western parts are much improved, I have been informed is chiefly small shells, and they, when calcin'd by the sun, are very good *alkali's*, and by consequence imbibers of *nitre*.

Dr. *Robert Wood* gives an account of bringing wheat, which is now common, and thought good to prevent *smut*.

Mariners

Mariners are said to attest that brackish waters are best for long voyages, and that offensive springs are purified by casting salt into them.

Several plants and fish thrive well in salt water.

But where he speaks that dung fertilizes, *ergo* salt, he mis-understands mightily; for the salt of dung is a quite different sort of salt from fossile marine.

He gives several instructions about the moderate use of salt in fertilizing land; but still speaks of my Lord Bacon's applying fertility to salt, as if he meant fossile or marine salt.

He also gives the manner of making *brine pans* and *brine*, also of *salterns* or *boiling-houses*, *grates*, *furnaces*, and *iron boiling-pans*, with the art of boiling *brine*, where he describes what is meant by *sand*, *dirt* and *bittern*; all which, because I have said something of the like in my *Cheshire-salts*, I refer to the book (tho' 'tis out of print, and hard to be got) or the places about *Portsmouth*, &c. where all may be seen.

He gives several articles of the *Dutch* about managing their salt, in order that great care might be taken of ours.

He inveighs greatly against foreign salt, and speaks as if we spent to the value of sixty thousand pound the year in it.

He taxes it with many faults; but as I have hinted before, I believe the chief difference between theirs and ours is only size and dirtiness.

As he beats down foreign salt, he commends Mr. *Alcorn's* at *Port-sea* by divers experiments, and seems to give reasons also, and among the rest says, that a *Winchester* bushel of it weighs sixty seven pounds, whereas the same measure of *Worcestershire salt* weighs but fifty six pounds,

104 *A COLLECTION for Improvement*

and that of *New-Castle*, by the Lord *Brereton's* experience, but forty eight pounds.

He gives many other accounts of the use of salt in the fishery and several other cases; but because I would hasten to other matters, and I think I have been particular enough in this history of *salt*, I take leave of it, and *Friday* next expect another subject from

Yours,

JOHN HOUGHTON, F. R. S.

FRIDAY, *October 23.* 1696. NUM. CCXXI.

How much salt made and imported from March 1695, to March 1696. Queries for improving this trade. Salt-petre, what it is.

I Thought I had last week taken a farewell of *salt*; but since an ingenious inquisitive friend has given me an account of all the *salt* that was known to be made in, and imported into *England* and *Wales*, from the twenty fifth of *March* 1695, to the twenty fifth of *March* 1696, and there was made in *England* about two millions thirty three thousand one hundred and forty bushels, and imported about ninety six thousand seven hundred and eighty bushels, which amounts to (2129920) two millions one hundred twenty nine thousand nine hundred and twenty bushels; which makes (53248) fifty three thousand two hundred and

of HUSBANDRY and TRADE. 105

and forty eight wey, a wey being forty bushels, each of which is fifty six pound, or half a hundred, and twenty hundred is a tun or a cart-load; so that here are fifty three thousand two hundred and forty eight cart-load; and if we are eight millions of people, 'tis little more than a peck of salt a year for each head, one with another, which is not quite five drachms, or little more than half an ounce each for butter, cheese, meat, and all other uses whatsoever. But whether any more be spent, and the revenue be abused, or whether 'tis the interest of the court to encourage the spending more, by encouraging the exportations of *bacon, butter, cheese*, or any other matters that employ salt, by lowering their duties, or whether a higher duty upon salt, to make amends for lowering other exported commodities, or whether giving a greater encouragement for exporting salt itself, or whether any of these considerations, or the like in any of my papers (in which there are a great many) be worth minding, I must submit to others whose concern it may be; and whether they will hear, or whether they will forbear, I'll go on with the like considerations, persuading my self that the practicable hints I have given (if put in execution) would encrease the revenue, enrich the kingdom, and make the taxations be paid with delight and pleasure. And now for *nitre* or *salt-petre*,

Which Bishop *Wilkins* reckons a factitious substance, having some analogy to such earthy concretions as commonly grow in mines, and are dissolvable by fire or water, and is not inflammable, and of the more simple sort, being a kind of salt of the air, used as a chief ingredient in the making of gun-powder.

Scroder

106 *A COLLECTION for Improvement*

Scroder and others reckon it a *white chrystalline* substance of a *biting bitterish* taste, *pyramidal* and extracted from a *fat* earth: but I cannot find in the chrystals any *bitterness*, but an odd sort of *taste* I cannot describe, with a *coldness* upon the tongue; neither can I see it *pyramidal*, but streight as if it were glass pipes joined one to another, though it does not appear hollow; neither can I understand what they mean by a *fat* earth. Let them shew. I rather think these hermaphroditical *sulphurous-saline* particles are imbib'd from the air by cavities in alkalous or other arid bodies, as I have shewn in the first volumes of these papers in fertilizing *earth* and impregnating *lime, chalk, &c.* But next *Friday* expect Dr. *Willis's* opinion from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, October 30. 1696. NUM. CCXXII.

Dr. Willis's opinion about nitre. The parts of nitre and reason of their separation. His proof of sulphur. The parts of gunpowder, and reason of their operation.

DR. *Willis* says, that the *nitre* or *salt-petre* is not to be enkindled by itself, though a strong fire will melt it; but being mixed with sulphureous things, it flames with force and explosion: for being added to common *sulphur, antimony* or *tartar*, it burns with a *thundering* noise:

of HUSBANDRY and TRADE. 107

noise: also if you put into it melted a burning coal, the flame is cast forth round about with a wind; so that the matter put in is flung up and down, and often clear out of the vessel. By this means the *nitre* is consumed, and the fixed salt (which is tartar) remains. When *nitre* is distilled, *sand* or *brick-dust* is mix'd with it, at least in double quantity, or else the *nitre* will not arise in vapour, which vapour is very red like flame in the receiver, and a sharp corrosive liquor is distilled, which dissolves most metals, even gold.

From hence it seems *nitre* consists of abundance of *salt* and a little *sulphur*, either ready for motion, tho' the salt is too strong for the *sulphur*; but when that is helped, by another enkindled *sulphureous* body, the particles of *salt* are disjoyned, and the little bodies of *sulphur* fly forth with violence.

To prove its sulphur he urges its *burning* (de-flagration) *use* in agriculture, *flaming* colour, and *generation* among *sulphureous* excrements of *animals*, which last I do not understand, for 'twill be generated in *lime* and *earth*, from which some has been extracted, which I think none allows to be *sulphureous*.

From these premises he thinks it not hard to unfold the nature of *gunpowder*. See the last *paragraph* but one. In *gunpowder* is *common sulphur*; because its *particles* being loose are apt to move a quick enkindling. There is *charcoal-dust*; because there the little *sulphureous* bodies (as in tinder) are brought to the very top of eruption, and are easily enkindled, and both these being fired and opposed to the *nitre*, they quickly loosen its frame, and send forth the *sulphureous particles* enclosed in it, which break forth from their impediments

pediments with a force, and at the *blast* of a bellows *encrease* the strength of the whole in firing.

The charcoal-dust is added in a moderate *quantity*, though it abounds with terrestrial *matter*, yet by reason of the *sulphur* being carried forth in it, it hastens the burning of this *mixture*: for the *coal* and *nitre* being beaten together is sooner fired, and with a greater (*explosion*) force flying out than *nitre* and *sulphur*; but if the *coals* be added (as they are wont to make it for *cannon* and *great guns*) in a greater *quantity* than it ought, and *improportionate* to the *nitre*, the immediate firing is somewhat *retarded* by reason of putting between the *earth matter*; and it happens that the *sulphureous* little bodies therein (apt to be hastily enkindled) are a little disjoyned; and so the *substance* of the infused powder takes fire successively, and by *parts*, and not all at once.

Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F.R.S.



FRIDAY, November 6. 1696. NUM. CCXXIII.

A book of nitre. A short account of it. The names, definition, analysis and generation of nitre. It's thought the cause of meteors, lightning and thunder, and that the brimstone and fire on Sodom was lightning. Its use to animals and vegetables. Its extraction and refining. Its virtues and uses. Why it burns not in making lapis prunella. Its use in chymistry, and why aqua-fortis and aqua-regis are so great dissolvents. The use of nitre in artillery. The reason for pulvis pyrius or gun-powder, and office of every ingredient. Why it's granulated, and reason of its great power. The mechanical uses of nitre. The use of it and its salt in cookery. That our nitre and the ancients are the same. Chrystals of nitre, oft found in Africa and India. Rock-petre from the Stiria in arch-cellar. The air thought full. 'Tis extracted from rain and dew. Where chiefly found. Advice about dunghills. The nitre from earth laid on brick or boards will not be rich. What places will have petre: how to find it: how deep it lies: how to increase petre or destroy it.

IN the year 1670 there was published a book by Nath. Brook at the Angel in Cornhill, and written

110 A COLLECTION for Improvement

written by *William Clarke*, entituled, *The natural history of nitre*; or, *A Philosophical Discourse of the nature, generation, place, and artificial extraction of nitre*, with its virtues and uses.

Here in the first chapter he gives the *names*, the *peripatetick definition*, the *chymical analysis*, and account whether this be the same with the *ancients*. In the second chapter, the *generation* and *place of nitre*, thinking it a general cause of *meteors*, a material cause of *lightning* and *thunder*, and that the rain of *brimstone* and *fire* on *Sodom* and *Gomorrhah* was lightning; and that *nitre* is express'd by the word *fire*. He shews the use of *nitre* to *animals* and *vegetables*. The third chapter gives the artificial manner of *extracting* and *refining* it. The fourth chapter gives the *virtues* and *uses*, and reason why in making *lapis prunella*, the *nitre* doth not burn: also an explanation of *scriptures*, where *nitre* is named. The use of *nitre* in *chymistry*, particularly in *calcination*, *sublimation*, *dissolution* in the great *Elixir*, and why *nitre* and its distill'd spirit *aqua-fortis*, and *aqua-regis* are so great *dissolvents*: also he gives its use in the art of *artillery*. Then he gives the rationality of the *pulvis pyrius* or *gun-powder*, and of the use and office of every ingredient, and shews why 'tis *granulated*, and the reason of its *great power*; also shews the *mechanical uses* of *nitre*, with the use of it and its *salt* in *cookery*. For all which I refer to the book it self.

But I cannot omit what is said by my very good friend, the ingenious *Tho. Henshaw*, Esq; who, I am told, has made more experiments about *nitre* than any man in *England*. His account is printed in the history of the *Royal Society*, where he seems well to prove that our
nitre

of HUSBANDRY and TRADE. III

nitre and that of the *ancients* are the same, and that in *Africa* and *India* there are often found chrystals of *salt-petre*, and that he himself has drawn very good *rock-petre* from the *stiria* hanging like *isicles* in *arched-cellars* and *vaults*. He also thinks the *air* to be *full*, and has often extracted it from *rain*, and especially *dew*, altho' but in small quantity, for the rains quickly wash it away: and the chief places for it are those cover'd from *rain*; from which he advises *dung-hills* to be so ordered; and observes, that let the *earth* be never so good, if it be laid on *brick* or *board*, the *petre* will not be so rich.

Any place thus qualify'd will have *petre*; and the workman knows when 'tis there, by laying a little of the *earth* on the end of his tongue; and if the ground be good, it continues rich to six, eight, or ten feet.

After the *petre* is extracted, if the earth be laid in again wet, 'twill be twenty years before plenty comes; but if well dry'd, 'twill come in twelve or fourteen years; but if pigeon's dung, &c. be mingl'd with it, 'twill be fit to dig again in five or six years: water strow'd on it will sink the *petre*; and he is inform'd that *soap-suds* will quite destroy it.

Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, November 13. 1696. NUM. CCXXIV.

Making salt-petre as now, a modern invention. When, and by whom gun-powder was invented, and how probably found out. The way to make salt-petre. The raw liquor and its colour. To know its richness.

THE aforefaid ingenious Mr. *Henshaw* fays, that *salt-petre*, and the way of drawing it out of the earth now in ufe, was a *modern* invention, is generally concluded, altho' the time when firft difcovered is unknown.

It feems to have preceded the invention of *gun-powder*, which the *Germans* afcribe to *Conftantine Autlitzer* or *Berthold Schwertz*, a Monk of *Friburgh*, and was in all probability difcovered, when the inventor taught the ufe of *guns* to the *Venetians*, at the battle of *Foffa Claudia*, when they obtain'd the notable victory over the *Genouefes*, anno 1380: for there is mention of *salt-petre* and *aqua-fortis* in the writings of *Geber*, a *Spanifh-moor*, and an *Alchymift*; but when he lived is unknown, tho' hundreds of years before *Raymund Lully*, who about one thousand three hundred thirty three published fome of his books, wherein he treats of *salt-petre* and *aqua-fortis*. It's no ill conjecture of *Mayerus*, that the aforefaid Monk being a skilful *Alchymift*, had a defign to draw a higher fpirit from *petre* than the common *aqua-fortis*, and that he might better open the body of *petre*, he ground it with
sulphur

sulphur and *charcoal*, by which composure he soon became the inventor of gun-powder.

The way to make *salt-petre* is to provide eight or ten tubs, able to contain about ten barrows full of earth each.

These tubs at top must be open, but in the bottom must be a hole (near that side you intend to place outermost) well fitted with a *tap* and *spigot* on the out-side downward; on the in-side near the *tap-hole* you must place a large wad of *straw*, and on that a short piece of *board*, both which is to keep the earth from stopping the *tap-hole*. When you have placed the *tubs* on stands, so that you may come with ease between, then fill them with such *petre-earth* as you have chosen, leaving only about a span's breadth between the earth and edge of the tub; then lay on the top of the earth, as near as you can to the middle, a rundle of *wicker* like the bottom of a basket, and about a foot in diameter, and by it stick into the earth a good strong cudgel, thrust pretty near the bottom: the *wicker* is to keep the water, when 'tis poured on, from hollowing and disordering the earth; and the cudgel is to be stirr'd about to give the *water* ingress to the earth upon occasion: then pour on the earth common cold *water*, till it stands a hand's breadth over the earth: when it hath stood eight or ten hours, loosen the spiggots, and let the *water* rather dribble than run into half tubs, set under the taps. This *lixivium* the workmen call their *raw liquor*: and note, if it come not clear at first drawing, you must pour it on again; and after some little time draw it off till it come clear and of the colour of *urine*.

114 A COLLECTION for Improvement

To know the richness of the liquor before boiling weigh a *vial* of *water* exactly, and by the same *glass*-full of that liquor you may find the difference in *weight*, which compared with the *quantity* of all our liquors, will give a near guess how much *salt-petre* you are like to make of that boiling.

Then pour on the same earth more common *water*, to bring away what remains in the earth of the former liquor; this will serve to pour on new earth, instead of common *water*, because it contains some *salt-petre* in it.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, November 20. 1696. NUM. CCXXV.

The further process of making petre. When boild enough, an hundred weight of liquor will yield about thirty five pound of petre. How to know when 'tis boild enough. How to manage the ashes, and the second boiling, which will produce some common salt. When passed through the ashes and boild enough, a hundred weight will yield about seventy pound of petre.

THE *petre* gotten out (as in the last) turn the insipid earth out of the tubs, which re-fill with new earth, and thus do till you have lixiviated all the earth. Then

Then fill your copper with your liquor; which copper for one of the profession must be about two hundred weight: let it strongly in a furnace of brickwork; besides, on the one side of your furnace you are to place a tub full of the liquor, which may dribble at a tap below as fast into the copper as the force of the fire doth waste your liquor, which intention is only to save charges in fuel.

When you have boil'd it so high, as a little thrown on a live *charcoal* will flash like gun-powder (which commonly happens after sixty hours boiling) at what time upon tryal a hundred weight of the liquor contains about thirty five pounds of *petre*. But without more ado, when a *brazen skimmer* is dip'd in, and the liquor hangs on it like oil, the work-men think it fit to be passed through the ashes in manner following.

You must prepare two tubs fitted as the first, where you put your earth; but at the bottom you must lay reeds or straw a foot high; over them place loose boards pretty near one another; over them a little more straw (which cover with any sort of wood-ashes, to half a foot of the top; then pour on the aforesaid liquor as it comes scalding hot to keep the ashes from the tap, and to give the liquor room to drein the better from them.) Then fill up the tubs from the copper, on the ashes contained in the first tub; then after a while draw it off at the top, and so continue putting on and drawing off, first at one tub of ashes, then at the other, till the liquor grows clear, and lose the thick turbid colour it had when it went on.

All the liquor having thus pass'd the ashes of both tubs, and left in them its greasie oil,

116 *A COLLECTION for Improvement*

you must keep it for a second boiling in a vessel by it self, and pour on the ashes a sufficient quantity of common water very hot, once or twice, to get what liquor is remaining in the ashes.

When you begin your second boiling, put into the copper the water that last went through the ashes, and as it wastes let your strong liquor drop in from the tub above describ'd, standing on the side till the liquor in the copper be ready to shoot or *chrySTALLIZE*.

Note, that toward the end of boiling there will arise store of *scum* and *froth*, which must be taken off with a great brass *skimmer*, made like a ladle, and usually about that time it lets fall to the bottom some *common salt*, which must be taken off for another use.

To know when 'tis ready to shoot into *petre*, a drop must be put on a knife or such like; and if it coagulate like tallow, and do not fall off when turn'd downwards, 'tis ready. Which also may be judged by its hanging like oil to the *skimmer*: when it is thus, every hundred weight containeth about seventy pound of *petre*.

Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, November 27. 1696. NUM. CCXXVI.

How the petre shoots. No salt without good management. To refine salt-petre. How to make scum rise. How to make petre-rock. The form of petre.

WHEN you find your *petre* liquor ready to shoot, as in my last, it must with great iron ladles be laded out into a high narrow tub, which the work-men call their *setling-tub*; and when 'tis so cool as to endure a finger, the common or cubick salt will begin to granulate, and to stick to the sides; then at the tap, plac'd about half a foot from the bottom, draw off the liquor into deep wooden treys, or brass-pans, and the cooler they stand the better will they shoot, and produce more plenty of *petre*, but 'twill be of no good colour till refined, but part *white*, part *yellow*, and some part of it *blackish*.

The salt sticking to the sides and bottom of the *setling-tub* is of the nature of common salt; and there is scarce any *petre* to be found without it, tho' no doubt but some of this is drawn out of the ashes by the second liquors: if it be foul, they refine it by it self, and about *London* sell it at good rates, for salting of *neats-tongues*, *bacon* and *collar-beef*: for besides a savoury taste, it gives a pleasing red colour to most flesh that is salted with it. *Pliny* says, *nitrum obsonia alba & deteriora reddit, olera viridiora*: but whether *salt-petre* doth so, my author has not try'd.

118 A COLLECTION for Improvement

When the liquor hath stood two days and two nights in the pans, the part uncoagulated swimming upon the *petre* must be carefully poured off, and being mingled with new liquors must again pass the ashes before it be boiled, else 'twill grow so greasie as never to generate any salt.

To refine salt-petre.

The copper being very clean, put in as much water as will dissolve the *petre* to be refin'd: when 'tis very hot, cast in the *petre* by little and little, stirring it with a ladle to dissolve the sooner; then encrease the fire till the liquor begins to boil. In the mean time, if any undissolv'd salt is at bottom, take it out with a skimmer, for it is common salt, and doth not so soon dissolve as the *petre*; then as the water boils, skim the froth as fast as it rises. When boiled so high that a drop will coagulate on a plate, then cast in by degrees either a pint of the strongest *wine vinegar*, or four ounces of powder'd or burnt-*allom*, and you shall observe a black scum to arise on the top of the liquor, which when you have allowed to thicken, you may easily take off with the skimmer: repeat this till no more scum arises. Some throw in a shovel-full of *quick-lime*, and say it makes *petre* the whiter, and *rock* the better. Take care the fire be not too strong; for while this is doing the liquor will be apt to boil over to great loss.

This done, lade out the liquor into a *setling-tub*, and cover it with a cloth, that it cool not too soon, and within an hour or two a thick yellow *feces* will fall to the bottom; then quickly draw off the liquor while hot into the *shooting-treys* or *pans*, and do as you did in making *petre*,
saving

of HUSBANDRY and TRADE. 119

saving you must cover the treys with a cloth; for then the liquor will begin to shoot at the bottom, which will make the *petre rock* into much fairer chrystals than otherwise. When no more *petre* will shoot (which is commonly after two days) pour off the liquor that swims at top, and put the *petre* into a tub with a hole at the bottom to drain, and when 'tis dry 'tis fit for use.

The figure of the chrystal is sexangular; and if it hath rightly shot, is fistulous and hollow like a pipe.

Next *Friday* expect more from

Yours

JOHN HOUGHTON, F. R. S.

FRIDAY, December 4. 1696. NUM. CCXXVII.

A curious experiment about salt-petre. A supposition about the salt of vegetables and animals. A salt from petre like salt of urine. All volatile salts much alike. The history of gun-powder. Of what made. Of what wood the coals. The secret in general.

I N my last I gave an account of refining salt-petre. Now take Mr. Henshaw's speculations about it, which, he says, if he could clearly make out, would lead us into the knowledge

of many *noble* secrets in nature: as also to a great improvement in the art of making *salt-petre*.

First then you are to observe, that tho' *petre* go all away in *gun-powder*, yet if you *fulminate* it in a crucible, and burn off the volatile part with powder of *coal*, *brimstone*, *antimony* or *meal*, there will remain a salt, and yet so fixed (very unlike common salt) that it will endure the force of almost the strongest fire, which being dissolved into water and spirit of *nitre* dropped into it, till it give over hissing (which is the same with the volatile part that was separated from it in the fulmination) it will be again reduced to chrystals of *petre*, as it was at first, which noble experiment the world hath been taught by an honourable member of the royal-society, with a train of such important observations as never before were raised from one experiment.

That which this ingenious gentleman aims at is, that if the spirit of the volatile *salt* of *foot*, or of the *urine*, *blood*, *horns*, *hoofs*, *hair*, *excrements*, or indeed any part of animals (for all abound with such a volatile *salt* fixed, and oil, as *petre* doth) could by the same way, or any like it, be reduced to *petre* or some *nitrous* salt not much differing from it; it would excellently make out a theory that he is much delighted with, *viz.* that the *salt* in *vegetables* and *animals* is but the *nitre* which is so universally diffused through all the elements (and must therefore make a chief ingredient in their nutriment, and by consequence, of their generation) a little alter'd from its first complexion; and that the reason why animals that feed on *vegetables* are obliged by nature, to longer meals than those that feed on other animals is, because animals are fuller of that *salt* than *vegetables*: and indeed

of HUSBANDRY and TRADE. 121

deed such animals are but caterers of it for man, and others, whom nature's bounty gratifies with a more lusty and delicious diet.

My author confesses he has been the more confirmed in this fancy, since he has often seen a friend of his with a natural and facile *Ευχερεια*, convert the greater part of *petre* into a *salt* so like the volatile *salt* of urine, that they are scarce to be distinguished by *smell* or *taste*, and yet he adds nothing to it, that can possibly be suspected to participate of that nature: but indeed all volatile *salts* are so alike, that it is not easie to distinguish them in any respect.

The history of making GUN-POWDER.

The materials of gun-powder are *salt-petre*, *brimstone* and *coal*; the *petre* and *brimstone* must be both refin'd if you mean to make good powder, and the *coal* must be *withy* and *alder*, equal parts, for *withy* alone is counted too soft; and some do commend *hazle* alone to be as good as the other two.

The whole secret of the art consists in the proportion of the materials, the exact mixture of them, that in every the least part of powder may be found all the materials in their just proportion; then the *corning* or making of it into grains; and lastly, the *drying* and *dusting* of it.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRI-

FRIDAY, December 11. 1696. NUM. CCXXVIII.

*The proportion of materials for gun-powder.
The mixture. The petre must be dissolved, and why. The description of the powder-mill.*

IN my last I gave you the general account of making *gun-powder*. Now for the particular.

The proportion is very differently set down by several authors. But the *English* author of fire-works says, that the proportions in *England* to make good, indifferent and ordinary powder is five, four, three parts of *petre* to two of *coal* and one of *brimstone*. Any above will make good powder if well mix'd; but the more *petre* the better, till you come to observe eight parts.

The next thing after the proportion is the mixture, about which most of the workmens pains and time is bestowed: for first in a horse-mill with two stones (like that they grind materials with at glass-houses) moving upon a marble bottom, which is edg'd with boards set sloping, that what slips from under the stones may slide back again, they grind the *brimstone* and *coal* each of them a-part as fine as possible; then sift each a-part, the *brimstone* through tiffany in a blotting-mill, such as bakers use for wheat-flower. The *coal* is sifted through lockram, in a bag made like a *shirt-sleeve*: for the convenience of the workman, 'tis done in a close bin, with only two
holes

holes for him to put his arms in and shake the bag about: whatsoever of each material is not small enough to sift through, is brought again to the mill to be new ground.

The *petre* must be dissolv'd in the copper, in as much water as will just take it up, and then be boil'd till it comes to the thickness of *hasty-pudding*. The reason of this operation is, because when the *petre* is thus soft, the other materials will the easier incorporate with it, and it will not wear the wooden pestles so much when it comes to the mill as when it is hardly dry.

The materials in this readiness are weighed (only the *petre* is weighed before dissolv'd) and by proportion carried to the mingling trough made of boards like a great chest without a cover, being about eight foot long, four foot broad and three foot high.

The *coal* is laid in first, the *brimstone* next, and the *petre* at top; then two men with shovels mingle them for an hour, and then 'tis ready for the mill.

The *powder-mills* seldom move with any thing but *water*: the great *water-wheel* is made like that of an ordinary *water-wheel*, either over-shot or under-shot, according to the quantity of *water*: to the axis of this wheel, a little within the mill, is fasten'd a lesser wheel call'd the *spar-wheel*, with strong coggs, which in their motion take hold of the round staves of another wheel about the same diameter, set a little above it, and fasten'd to the end of a beam of fifteen or sixteen foot long, laid *parallel* to the horizon, with an iron gudgeon at the other end, to *facilitate* its motion round. This is call'd the round *beam*: out of it come a certain number of arms about nine inches long and three inches broad,

broad, which in their going round meet with lesser arms (called *tapes*) coming out of the pestles (small quarters of timber perpendicularly to the horizon about nine foot long and four inches broad set in a slight frame to keep them steady;) by these arms the pestles are lifted up about two foot and a half, and then let fall into a strong wooden trough, set under them, wherein the powder is pounded.

Yours

JOHN HOUGHTON, *F R S*.

FRIDAY, *December* 18. 1696. NUM. CCXXIX.

The powder-mill described. How the pestles work and why. How the powder is ordered in working. Signs of the mill firing. How powder is corned, dried. The stove described. How heated.

TO end the description of the *powder-mill*, every mill hath two troughs and about sixteen pestles; every pestle hath fastned to the lower end a round piece of *lignum vitæ* of about five inches long, and three and a half diameter; and into the bottom of the trough, just where the pestle is to fall, is let in another piece of *lignum vitæ*, of the fashion of an ordinary bowl, split according to its longest diameter. The pestles are not lifted up all together, but alternatively, to make the powder turn the better

of HUSBANDRY and TRADE. 125

ter in the working; and for the same reason round troughs are counted better than square.

To make excellent powder it ought to be wrought thus thirty hours; but of late they will not afford it above eighteen or twenty hours. Once in eight hours they use to moisten the powder with a little fair water: others who are more curious put water something thickned with quick lime; others use white-wine vinegar; others *aqua-vitæ*: but if it be not moisten'd once in eight hours the powder will grow dry, and in half an hour after take fire. As soon as the powder grows dry you may find it, tho' at a distance, by the noise of the mill; for then the pestles will rebound from the bottom of the trough, and make a double stroke.

The only *danger* to the mill is from the trough: for often the iron gudgeons grow hot for want of *greasing*, and then the dust that flies about will be *apt* to fire, and so the mill blows up.

From the mill the powder is brought to the *corning-house*, of a middle temper between moist and dry. The way of corning is with two *hair-sieves* joined together, the upper enclosing some part of the hoop of the lower *sieve*. The upper hath holes of the size you will have the powder grain'd at; the holes of the lower are much less. The upper they call their *corning-sieve*, the other their *wet-duster*. They lay the powder on the upper, some two inches thick, on that a piece of heavy wood made like a trencher of about eight inches *diameter*, and two and a half inches in thickness, called a *runner*, which, when the *sieve* is moved, by its weight and motion forces the powder through the upper *sieve*, and that *corns* it. Then the lower receives the powder, and lets the dust go through into a bin,

126 A COLLECTION for Improvement

over which the *sieve* is shaken, called the *dust-ing-bin*.

The *powder* thus *corned* is *laid* about an inch and half thick on the *drying-sieves*, which are made of coarse *canvass*, fastned to slight *frames* of *deal* about an ell long, and some twenty inches broad; and thus 'tis carried into *stoves* to dry.

The *stove* is commonly a little room about eighteen or twenty foot square, with *ranges* of small *fir-poles* about two foot one above another, to lay the *drying-sieves* on, but only on that side the fire is made. Besides a *glass-window* to give light, there must be a *small hole* at the top of the *room* to let the *steam* out, else the *powder* will be longer drying, and oft by return of the *steam* the top of the *powder* will be so crufted, that the lower *part* will not dry.

The room is *heated* by an *iron* about a yard high and half a yard broad, cast in the form of an *arch*, equal to a *semiquadrant*, and placed in the *back* of a *chimney*, the forepart whereof is like a furnace; and to avoid *danger*, opens into another little room *apart*, called the *stoke-hole*.

Yours, &c.

JOHN HOUGHTON, F. R. S



FRIDAY, December 25. 1696. NUM. CCXXX.

The drying of the gun-powder. Best in the sun. Great corns for cannon powder, small for musquet and pistol. The difference between good and bad powder. Five score pounds is a barrel. The uses of gun-powder. It saves men from destruction. Dr. Hook's thoughts of nitre. His proof that nitre is in the air. Medicines from nitre.

TO dry the gun-powder, as in my last, 'tis brought into the stove, before it be heated; and is not taken out till the stove be cold; and about eight hours is required to the drying it. In hot countries the sun is the best stove, and a great deal of danger and charges that way avoided.

The powder being dried, is brought again to the corning house, where it is sifted over the dusting-bin in other double sieves, but without any runners. These sieves have both of them smaller holes than the former. The upper sieve is called the *separator*, and serves to divide the great corns from the lesser. The great corns are put by themselves, and serve for cannon-powder. The lower sieve is called the *dry-duster*, and retains the small corns (which serve for musquet and pistol) and lets fall the dust into the bin, which is to be mingled with fresh materials, and again wrought over in the mill.

So

So that good powder differs from bad, besides the well-working and mingling the materials, in having more *petre* and less *coal*: and lastly, in the well dusting of it.

The last work is to put the powder into barrels, every barrel is to contain five score weight of powder; and then 'tis ready for *sale*. Thus far this curious gentleman Mr. *Henshaw*.

'Twould be endless to reckon up the uses of gun-powder: but its chief use is to kill men, and batter places in order thereto; and for this 'twas a rare invention: for tho' it kills more men in short space; yet it ends battles sooner, and nothing nigh so many are killed, as when bows and arrows were used; and had *Troy* been now standing, it would not have been plagued with a ten years siege. Besides this, how does it blow up old buildings, mines, trees and several things in a moment, that otherwise wou'd have cost vastly more labour and charge: with help of it we destroy both birds, beasts and serpents, and sometimes fish, that would annoy us: and with it we catch such as should do us good: it secures us from enemies, and is a good medicine against many *maladies* as may well be known by artists from consideration of its ingredients. 'Tis like *Mercury*, good for a multitude of uses, therefore *capable* of doing great mischiefs also; may it come into the hands of none but wise men.

Thus have I done with gun-powder, and thought to have done with *nitre* also; but that I have learn'd something from the ingenious Dr. *Robert Hook*, F.R.S. who says, *nitre* will not burn, tho' you make it red-hot in a crucible; but if you put to it, not only a live coal, but a piece of cold wood, or any combustible
matter,

of HUSBANDRY and TRADE. 129

matter, it will burn that presently, and spend itself till 'tis *satiated*, and becomes a fixed *nitre*; after which 'twill dissolve no more, nor burn any thing.

As a proof of *nitre* in the air, a live *coal* may be blown in a close box (in which bellows are included) till it's blown out, the air being then *satiated*, and not fit to make any further dissolution or burning; but then, if by a *tobacco-pipe* or such like, you blow in fresh air, 'twill renew the dissolution, or re-kindle the fire: from which he conceives there is *nitre* in the air.

Beside, the *spirit of nitre*, *aqua-fortis* and *aqua-regia*, are made from *nitre*, which are the common dissolvents of our *metals*; and with them Mr. *Salmon* in his *dispensatory* has given the receipts of fifty two medicines; and I having writ all that I thought fit in ten of these *papers*, where, I think, is a more perfect history of it than has hitherto been, and take leave of it, and you may expect another *subject* next *Friday* from

Yours, &c.

JOHN HOUGHTON, F. R. S.



FRIDAY, *January* 1. 169 $\frac{6}{7}$. NUM. CCXXXI.

The quantity of nitre brought to London 1694. The want of foreign trade the reason of badness of trade among clothiers and weavers. A supposition. Great profit by the Indian trade. It will, if encouraged, find employment for a great many people and ships.

IN my last I ended the history of *nitre*, *gunpowder*, and all things I could think proper to say thereon; only I omitted the quantities of *nitre* imported, which from *India* was eight thousand nine hundred and eighty eight bags, from *Germany* three hundred and eighty three hundreds, and five cakes, and nine vats, from *Holland* two thousand nine hundred hundreds and one thousand three hundred and seven tuns. How much this makes is not to my purpose; because 'twas time of war, wherein the trade to *India* was much interrupted; it can't be a standard for the common quantities brought thence; yet suppose it all to be two thousand tuns, here would have been freight for four good ships, had it been brought by us from *India*. I don't complain of having it elsewhere: necessity has no law; but I believe the discouragements to the *East-India-Company* have hinder'd their stores: but whether it comes in the company's or interloping *ships*, 'tis better brought by our selves than neighbours: for the freight of such goods amounts

of HUSBANDRY and TRADE. 131

amounts to a great part of the value; and I could heartily wish that an exclusive or open trade were settled; and about a year since I gave my opinion of trade in a *joint-stock*, as the *India* or *Guinea*; or *regulated*, as the *Turkey* or *Hamburgh*; or in *free-trade*, as to *Spain* or *Portugal*: and thither I'll refer you.

And now I shall say more of the *East-India* trade; because several *weavers*, *clothiers*, &c. are petitioning against the wearing of several *East-India* goods, thinking it decreases their employment. *Poor souls!* I pity 'em: something hurts 'em; they know not what; and they accuse the foreign trade, when as 'tis the want of that is the cause; as I'll strive to prove.

Suppose there be eight millions of people in *England*, and one with another they should annually each consume of *India* clothes to the value of twenty *shillings*, as sold at the publick *sale*; this would amount to eight millions of pounds; and I doubt not but the other goods we should consume with such a trade would make it ten millions.

This at twenty *per cent.* custom, ten *per cent.* freight, ten *per cent.* petty-charge and damage, and ten *per cent.* profit (and these in a great many cases are more) will make them cost in *India* but five millions; the rest *England* saves.

This must be paid for in *goods* or *money*: if in *goods*, then for what costs us here ten *shillings*, will sell at return here for twenty *shillings*, and be doubly as fine and useful; or else she should not buy of our own for ten; and where's the hurt to the *English* goods, if the *Indian* consumes ours, and we theirs.

This five millions of goods carried thither from hence would at ten pounds the head (which

132 *A COLLECTION for Improvement*

is more than all that belongs to the clothing or weaving trade earn one with another) employ five hundred thousand people, and the five millions gain'd by custom, &c. as above, would at the same rate employ five hundred thousand more; which would go a great way to ballance our clothiers and weavers who want employment and complain.

But beside this, ten millions of goods at one hundred thousand pounds to a *ship*, will employ one hundred *sail* of *ships*, with one hundred *seamen* in each; in all ten thousand: and there must be as many more men and ships to go while the other come home, if you'll carry on the trade; and had we such a trade here, and our neighbours did not the like, I doubt not selling to them at least as much as we consumed; and that would *quadruple* our *ships* and *men*, and who then wou'd dare to quarrel with us?

Yours, &c.

JOHN HOUGHTON, F. R. S.



FRIDAY, January 8. 1697. NUM. CCXXXII.

'Tis the East-India company's interest to carry out goods rather than money, if at any tolerable rate they can vend'em it. They do just like the complainers against them. 'Tis plainly proved, that to give money for Indian goods can be no damage, but 'twill certainly enrich us. In all likelihood we lose no more men by going to India than to other places; but if we do, 'tis worth while.

I N my last I consider'd driving a great trade to *India* with goods for goods: but some will say for their goods must be carried money; and this they are angry at. Ah, foolish children! who has bewitched them to exclaim against that bread should nourish them! Will the *East-India* company be at charge for so much *ballast* as will trim their ships, and carry nothing else but money? If they can carry no other goods for more profit, especially when they pay no freight, as they do not outwards? If they will, I wish they were patients to the learned Dr. *Tyson*, and I their apothecary; for surely sitting in *Committee* don't become them. If they are men who love their own interest, 'tis a plain case, they'll carry goods rather than money, if they can vend them. But if they cannot, what would you have them do? I dare say, they never carry money, but when they believe 'twill turn to the best account. Do

not those weavers do the same, when they pay *money* for their necessities to consume, and sit to work, when as those that take it, they know will never lay out one groat with them again; and they care not, so they can sell it to others for *money*, wherewith they'll again go to market? Don't all of them sell to the *merciers*, and yet buy cloth at the *woollen-draper's*? Were it not thus, *money* would be useless, and there could be no trade in the world but by barter.

But to please these men, suppose we should send this five millions mention'd in my last; where shall we have it? It grows not with us: then we must get it from abroad. For what? To give *money* for *money* will do no good. We must give our goods for it. And if we give our goods for *money* to buy goods, is it not the same as to give goods for goods? Only we are longer about it; and well paid for our labour. If we give *foreign goods* for *money* to buy *foreign goods*, where is the hurt? If we give our *own goods* for *foreign goods*, where is the hurt either? Only in both cases we are paid for carrying and re-carrying.

If the *East-India* company want *money* to carry to *India*, they'll give a great price for it, and that will bring all the *money* in *Europe* hither, as it did the guineas, when at thirty shillings. And will they that bring it, give it away, rather than carry our goods in lieu thereof? Fye! fye! They'll buy up our goods as we do the *Indians*; and as industriously push them off, as we do theirs.

I hear of another complaint against the *India-trade*, viz. it destroys a great many men: I grant it. But if it be enquired of our colonels at land, I believe they lose well nigh as many when they don't fight, and in voyages to the
West-

of HUSBANDRY and TRADE. 135

West-Indies; if they lose in one year five in twenty 'tis no great matter. But if in two years voyage to *India* there be forty lost out of one hundred it makes a great cry, tho' 'tis in proportion ten less than the other. But suppose we do lose some more men than ordinary, and enrich the nation; don't that still bring more people in their room? Do the *Scots* generally travel to worse countries than their own? And do the *French refugees* go to the *Orcades*, *Norway*, or *Russia*? No, no; they came to *England* and *Holland*, where there was *trade*; and a ten-fold encrease of *trade* will bring them hither ten-fold. If any can answer what I have said, I would gladly see it, and am

Yours &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, January, 15. 169⁶. NUM. CCXXXIII.

Vitriol, its description. How much imported in one year. Notes on it. Of what made. Aqua-fortis, of what made. What sorts of copperas in Gresham-college.

HAVING ended the history of *nitre*, *gun-powder*, and all belonging thereto, that I could think necessary, with some considerations on the *India-Trade*, I come to the next in my catalogue of importations; which, agreeable to *Bishop Wilkins's* method, is *vitriol*. This he reckons among such earthy concretions as commonly

136 A COLLECTION for Improvement

ly grow in mines; or such factitious substances, as have some analogy to these, and are dissolvable by fire or water, and accounts it not inflammable; a more simple sort of salt of *metal*, which he also calls *chalcantus*, *copperas*.

Of this *vitriol* there is said to come in one year from the *Streights* eight hundred and sixteen pound of the *Roman vitriol*, from *Germany* one hundred and twenty hundred of *copperas*, and one hundred and eighteen hundred of blue *copperas*, and from *Holland* two hundred hundred of blue *copperas*, and one hundred of green *copperas*, and from *Germany* thirteen dozen ounces of white *copperas* gilt powder, and two thousand shells for *japan work*.

Now the quantity of *Roman vitriol* imported is inconsiderable; and I presume 'tis brought in our own ships, but I doubt the *copperas* is not so, and between four and five hundred tun is a considerable quantity, and worth thinking whether it cannot be made here; and if not, whether a little higher duty would not do well, except it were brought in our own bottoms.

As to the gilt powder, the shells for *japan work*, the matter is not great yet; but 'tis chiefly manufacture or mill-work: and why we should not encourage the getting all such here, I see not.

As to green *copperas*, we out-do every body: but of that expect more hereafter.

It is made of *stone*, and also *copper* and *iron* adjoining to the stone of a *copper-mine*, is a greenish matter, which I take to be this.

The dispensatories are full of medicines made from it, reckoning it of very great use, not only in medicine, but also in a great many arts, particularly in dying, where they use much *aqua-fortis*,

of HUSBANDRY and TRADE. 137

fortis, which is made of two parts *vitriol*, and one part *salt-petre*, which will also dissolve silver, but not gold: but if a certain quantity of *sal armoniack* be added, then 'twill dissolve gold and not silver.

Dr. *Nehemiah Grew*, in his *Museum Regalis Societatis*, gives an account of a great many *vitriols* in their repository, viz. *blue*, *native* and *chrySTALLIZED*; from copper-mines in *Hungary*, *green*, *native*; from the silver-mines there, *native*, *green*, with some rays of a pale *blue*: others of a pale *purple*; and consisting of *pointed crystals*, *native white vitriol*: *white vitriol oar*, of a pale *okre* colour, *native verdigrease*, of a *bluish green*, all from the same place. Also there is a rich oar of *green copperas*, from *Cornwall*, and a poorer sort, one side of a *bluish ash-colour*, the other of a *yellowish green*, a *fibrous* or *stiriated* var, of *green copperas*.

Next Friday expect more from

Yours, &c.

JOHN HOUGHTON, F.R.S.



FRI-

FRIDAY, January 22. 169^e. NUM. CCXXXIV.

Copperas stones where found, and best. Their differences. Several things found in them. What uses these stones are put to. How beds are made to hold copperas stones. How copperas is made. The stones are six years preparing. What ripens them, and what retards. Stones will ferment. How often the bed is refreshed, and in what manner. A cistern of seven hundred tun.

IN my last I promised more of green copperas, and the manner of its make take as given in by Mr. Daniel Colwall to the Royal Society.

Copperas stones, which some call gold-stones, are found on the sea-shore in Essex, Hampshire and so Westward. Great quantities are in the cliffs; but those not so good as on the sea-shore, where the tides ebb and flow over them.

The best of these stones are of a bright shining silver colour; the next of a deep yellow rusty colour; the worst have gravel and dirt in them, and so of a sad dusty colour.

In the midst of these stones are sometimes found shells of cockles, and other small fishes, small pieces of the planks of ships, and also pieces of sea-coals are found turn'd into these stones, the outside hard, and the inside longer before it's petrified: the brightest are used in wheel works, pistols and fusils.

of HUSBANDRY and TRADE. 139

In order to the making of *copperas*, they make beds as the ground will permit. Those at *Deptford* are about one hundred foot long, and fifteen foot broad, where they dig twelve foot below the surface of the earth, and so shelving downwards towards the middle. The bed they ram very well, first with strong clay, then with rubbish of chalk, whereby the liquor draining out of the dissolution of the stones is conveyed into a wooded shallow trough, laid in the middle of the bed, and covered with a board, being boarded on all sides, and laid lowest at one end, whereby the liquor is conveyed into a cistern under the boiling-house.

The beds indifferently well dried, they lay on the stones about two foot thick. When a bed is all laid over with new stones, it will be five or six years before they will yield any considerable quantity of liquor, and till then that will be but weak.

They ripen by lying in the sun and rain, and by experience it has been found that watering them, although with water prepared by lying in the sun and drilling through very small holes of a watering pot, does retard the work.

In time these stones will turn into earth, which will swell and ferment like leavened meal.

The bed come to perfection, is once in four years refresh'd by laying new stones on the top.

When a new bed is made, 'tis with a good quantity of the old fermented earth mingled with new stones whereby the work is hastned, and the old earth never becomes useles.

The *cistern* before mentioned is made of strong oaken boards well joyned and kaulked, that at *Deptford* will contain two hundred tuns. Great care is taken that the liquor drains not through
the

140 *A COLLECTION for Improvement*

the beds or the cistern. 'Tis best to divide the cistern in the middle with oaken boards kaulked as before, whereby one part may be mended in case of a defect.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, January 29. 1697. NUM. CCXXXV.

The tryal of goodness of copperas water.

The liquor will ferment. It will burn.

How the boiling is managed with iron.

One thousand five hundred weight to a boiling. How to try when boiled enough.

A way to improve boiling. A caution.

IN my last I gave some account of a copperas work, to carry it on note, the more rain falls, the more and weaker will be the liquor, the goodness whereof is tried by weights prepared for that purpose: fourteen penny-weights is rich; otherwise put an egg into the liquor, the higher it swims the stronger it is; sometimes 'twill swim near half above the water.

Within one minute after the egg is put in the circum ambient liquor will boil, froth, and bubble as if fire were under it, and in three minutes the shell will be quite worn off.

Any drop of this liquor falling on the manufacture of hemp, flax, or cottons, will presently

burn a hole through: it will also burn leather and woollen; but the coarser the wooll, the more it resists the corroding quality.

From the cistern of liquor is pump'd into a boiler about eight foot square, containing about twelve tuns, which is thus order'd:

First they lay long pieces of cast-iron twelve inches square, as long as the boiler, about twelve inches each from other, and about twenty four inches above the *superficies* of the fire; then cross-wise they lay ordinary flat iron bars, as close as they can lie, the sides being made up of brick-work. In the middle of the bottom of the boiler is laid a trough of lead, wherein they put at first one hundred weight of old iron.

The fuel in boiling is *New-Castle coals*. By degrees in the boiling they put in more iron, amounting in all to one hundred and fifty weight in boiling; and as the liquor wastes they pump in fresh, whereby, and by a defect in ordering their fire, they were wont to be above twenty days before it was enough; which they dry by taking up a small quantity of liquor into a shallow earthen pan, and observing how soon it will gather and crust about the sides thereof. But now of late, by the ingenuity of Sir *Nicholas Crisp*, the work is much facilitated: for at his work at *Deptford* they boil off three boilers of ordinary liquor in one week; which is done, first by ordering the furnace so, as the heat is conveyed to all parts of the bottom and sides. Secondly, as they were wont to pump cold liquor into the boiler to supply the waste in boiling, whereby the boiler was checked sometimes ten hours; now Sir *Nicholas Crisp* has a vessel of lead, which he calls a *heater*, placed at the end, and a little higher than the boiler, which

142 *A COLLECTION for Improvement*

is supported by bars of iron, as before, and filled with a liquor, which by a conveyance of heat from the furnace is kept near boiling hot, and so continually drains into the boiler, to supply the waste without hindring the boiling.

Thirdly, by putting in due proportions of iron from time to time into the boiler. As soon as they perceive the liquor begin to boil slowly, they put in more iron, which will soon quicken it.

Beside, if they do not continually supply the boiling liquor with iron, the *copperas* will gather to the bottom of the boiler and melt; and so it will do, if the liquor be not presently drawn from the boiler into a cooler, as 'tis enough. Next *Friday* expect the rest of this account from

Yours, &c.

JOHN HOUGHTON, F.R.S.



FRI.

FRIDAY, February 5. 169⁶/₇. NUM. CCXXXVI.

A description of the cooler and copperas. Copperas-water good for sore eyes. Copperas boils best with iron. Wet and dry causes destruction. The sea turns to stone. How to make ponds, rain and other water differ. A mistake. Boiling improved. Fermentation illustrated.

TO end the history of copperas-making, note, that the cooler is an oblong, twenty foot in length, and nine foot over the top, and taper towards the bottom, about five foot deep, made of tarras, into which they let the boiler run as soon as it is boiled enough. It will be fourteen or fifteen days before it hath gathered as much as it will, and then it will presently waste. It will gather as much in the sides as in the bottom, viz. above five inches thick. Some put bushes into the cooler, about which copperas will gather; but at Deptford they use no bushes.

That which sticks on the sides and to the bushes is of a bright green colour, by reason the dirt doth not settle with it. At the end of fourteen days they save the uncongeal'd liquor.

The copperas they shovel from a floor adjoining; so that the liquor may drain from it into a cooler. The steam which comes from the boiling is of an acrimonious sour smell: it cures sore eyes, and so doth the liquor injected therein.

Copperas

144 *A COLLECTION for Improvement*

Copperas may be boil'd without iron, but with difficulty, because so the boiler will be in danger to melt. In stirring the earth on the beds sometimes they find pieces of *copperas* congealed by lying in the sun.

Thus far Mr. *Colwall*, and 'tis a curious history: but farther note, what great effect *fermentation* has, even in stones, when they lie wet and dry, by ebbing and flowing of the sea, rather than in the cliffs where they are otherwise; and 'tis this wet and dry destroys *wood* and divers other things, as in these papers I have formerly shewn.

By the *shells*, *gravel*, and *dirt*, in the stones 'tis a plain case they grow; and by the *sea-coals* being turn'd into these stones, it is as plain it proceeds from the water getting into the pores of the coal, and there leaving a *salt*, *terrestreity*, or *lapidescent* matter, which, for ought I know, may gather the spirit of the air, and turn it by some other mixture to *vitriol*, as some earths turn it into *nitre*.

The *manner* of making the bed with *clay* and *chalk* I suppose will shew how ponds may be made in any sort of *downy* or other ground; I believe there are divers such as these near *Ebbisham* in *Surrey*, belonging to the Lord *Berkeley* and Sir *Robert Howard*, which are great helps to the *cattle* now living on the plentiful *sant-foine* growing on that, which was formerly reckon'd very barren ground.

By the *retardation* of the ferment of the stones, when water is poured on them by a *watering-pot*, may be seen the great difference between rain and other water.

The iron in one boiling, instead of one hundred and fifty, should have been one thousand five hundred

hundred weight. From the same *paragraph* may be noted how art may be improved: may not such manner of boiling be useful to many other purposes, as *brewing, dying, distilling, &c.*

In the second volume of these *papers*, I shewed the manner of *fermentation*, a *consideration* of which, compared with the *precipitation* or gathering of this *copperas*, will further illustrate it.

This ends the history of *vitriol*. Next week expect another subject from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, February 12. 169⁶/₇. NUM. CCXXXVII.

How much brimstone imported to London, Anno 1694. Holland an industrious place and why. A wish. Sulphur describ'd. Divers sulphurs in Gresham-College. Sulphur in coal-mines. A cause of earthquakes as thought. Sulphureous waters.

IN my last I ended my history of *vitriol*. Another thing imported is *brimstone*, of which there came in the year 1694. from *Holland* six hundred and forty eight hundred, from *Spain* four hundred, and from the *Streights* one thousand two hundred and seventy two hundred, and two hundred and fifty six pound; in all one thousand nine hundred and twenty four hundred,

and two hundred and fifty six pound, almost one hundred tun.

How this agrees with the quantity of powder spent, is hard for me to know; but this I observe, that *Holland* is one of the bravest countries in the world: for there is hardly any thing in other parts, that may not be had there. I speak this to their commendation; and I must confess, I wish that *England* would imitate them; which, I am afraid, we shall never do, till we get more people, and our land grows so dear as hardly to allow a purchase for any, which will make our wealth be in trade, and us keep as great magazines of merchandize, as our neighbours.

This one hundred tun is little more than a quarter of an ounce for each head in *England* for a year, which is but a small matter, considering the war, flower of brimstone and all other uses. However in times of peace I hope we shall bring all we want in our own bottoms from the place of its product, which will help us something; and if we'll contrive the easiest ways, I know not but we may serve the world with gunpowder.

Dr. *Wilkins* reckons *sulphur* among such earthy concretions, as commonly grow in *mines*, and are dissolvable by fire, inflammable, of a dry consistence, and yellowish colour.

Dr. *Grew*, in his *Museum*, gives an account of a great many *sulphurs* in the repository at *Gresham College*, particularly of *native sulphur*, *chrystalized*, of a pale golden colour, and semiperspicuous, sent from *Peru*, the like from the *pike of Tenariffe*. A lump of *native sulphur*, like *olibanum drops*, or *opacous yellow amber* from the same place. Two pieces of *ore*, the one, earth of a brown, the other, stone of a *sand* colour
and

of HUSBANDRY and TRADE. 147

and gritty. *Native sulphur of Iceland*, of the colour of common factitious *brimstone*, and immers'd in a stony bed. Some of a curious *orange* colour, extracted from *gold ore*. *Sulphur ore of Freyburg*. One piece almost like *cinnabar*, which in fire smells like *brimstone*, but flames not. Two of *blackish* and *ash-coloured parts* mix'd with *red*; in the fire they are like the first, inflammable, but smell not so strong. *Green sulphur ore*. *Ore of Iceland*, opacous and immers'd in a bluish *glebe*.

Dr. Plot in his history of *Staffordshire* says, that the *coal of Wednesbury* has much *sulphur*, from whence might be made *rolls*, *flower of brimstone*, or *oyl of sulphur per campanam*, and believes that and the *pyrites* to be the cause of *earthquakes*.

He also gives accounts of divers *sulphureous waters*, with the many cures they have done; but being *sulphur* appears not, but is found out by divers experiments and conclusions from them, thither I refer the reader; and next *Friday* you may expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, February 19. 169 $\frac{6}{7}$. NUM. CCXXXVIII

Nature of vitriol, sulphur and alom. Vitriol and alom to be made from common salt. Okre, its description and reason for its name. Ten earths over okre. Two sorts of okre. How some is managed. Where more okre is found. There are divers sorts.

IN N^o. 103. and 104. of the *Philosophical Transactions*, there is a curious account of the nature of *vitriol*, *sulphur* and *alom*, which epitomizing would spoil; but I hope this notice will make every *Englishman* (that shall have to do with any of them) read it. The author (whose name is not there put) also affirms that he can with *common salt* make both *vitriol* and *alom*, hardly distinguishable from the *natural*. His observations are most from experiments, and seem to be very curious.

From *sulphur* or *brimstone* are made abundance of medicines; but by reason there are accounts of them in every dispensatory, I shall refer the reader thither.

The next imported commodity is *okre*, which is reckoned among the earthy concretions not dissolvable, of which there are two sorts, *yellow* and *red*, of which I find imported only one barrel, which argues us not to want much; and by Dr. Plot's account in his history of *Oxfordshire*,

shire, we have a great deal: for he says, the *okre* of *Shotover* may challenge a principal place, it being accounted the best in the world, of a yellow colour, and very weighty, much used by painters, simple of itself, and as often mixed with the rest of their colours. He supposes reasons for its name, and thinks it might come from the river *Ochra*, that runs through *Brunswick*, whose banks yield great quantities.

'Tis dug now at *Shotover*, on the East-side of the hill on the right hand of the way leading from *Oxford* to *Whateley*; the vein dips from East to West, and lies from seven to thirty feet in depth, and between two and seven inches thick, enwrapp'd, he says, within ten-folds of earth. (*Quære* if more than covered with so many) viz. a reddish earth, a pale blue clay, a yellow sand, a white clay, an iron stone, a white and sometimes reddish maum, a green, fat, oily kind of clay, a thin iron-coloured ruddle, a green clay, again, another iron rubble almost like smiths cinders, and then the yellow *okre* of two parts, viz. the stone *okre* which may be called *native*, because ready for use as soon as digg'd; and *slay okre*, which, because of the natural inequality in its goodness, they wash and steep two or three days in water; then beat them with clubs on a plank into thin broad cakes; then cut it into squares like tiles, and put it on hurdles laid on trestles to dry, which, when thoroughly done, 'tis fit for the merchant.

The stone *okre* is preferred far before the clay, although formerly it was otherwise.

He speaks of some other of inferior sort, between *Ducklington* and *Whitney*, and at *Garlington* and *Purton*, and in his history of *Staffordshire*, he speaks of yellow and red near *Stansop*,

150 *A COLLECTION for Improvement*

in the parish of *Alstonfield*; the yellow *okre* found upon *Willenball-Green* about a yard deep, which separated from *gravel*, and made in *cakes*, as above, they sell for four pence the dozen, for the glover's use, as a blue *clay* so managed, is for *ash-colour*. *Ruddle* or red *okre* they dig very good at the parish of *Ipston*, which lies chiefly in their best lands. He heard also of some about *Dilborn*, and *Kingswood* within *Wrottesly-Park*. And so much for *okre*. Next *Friday* expect some other matter from

Yours &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, February 26. 1696. NUM. CCXXXIX.

Jett, its description. How much imported. Coal differs little from jett. How much imported in 1694. Coal in England like Scotch-coal. Coal, what in Dr. Plot's opinion. Cannel-coal like black marble. Its many uses. Where found and how deep. The Lancashire-coal is better than Staffordshire. Staffordshire coal how managed for fires. Peacock-coal, its use. The common coal very delightful. How many collieries. How many tuns some yield yearly. From one shaft has been drawn five hundred pounds worth of coals. Wood grows scarce, and coal is burnt in the bed chambers.

THE next thing to *okre* imported, is *jett*, which Bishop *Wilkins* reckons among the
earthy

of HUSBANDRY and TRADE. 151

earthy concretions not dissolvable, and distinguished by a black colour, of a finer grain. Some reckon it a kind of *Bitumen*.

There was imported from *Flanders* one hundred and fifty pound of *jett-beads*. I can say nothing to these, only 'tis pity we do not make them our selves.

The next imported commodity is *coal*, whose description is the same with *jett*, only of a coarser grain.

In the year 1694 there were imported from *Scotland* one thousand four hundred seventy three tons of coal. A matter of no great consequence, except we could be conveniently furnished with the like from our selves, which I do not find *London* can, tho' I have heard of a great deal such in *England*, which are large, will flame and glow till covered with its own white ashes.

Of *coal* I understand we have abundance in *England*, northward; but I perceive Dr. Plot could find none in *Oxfordshire*, but in *Staffordshire* great variety; and in his judgment to be nothing else but *bitumen* indurated by subterranean heats.

There is a sort of *cannel-coal* of so close a texture, that it will take a passable polish; and the choir of the cathedral church of *Lichfield* is in a great part pav'd *lozengy black and white* with *cannel-coal* for the black, and *alabaster* for the white, and when kept clean, it appears like black and white *marble*. It turns like *ivory* into many pretty knacks, *ink-boxes*, *candlesticks*, &c. They put it also into *salts*, *standishes*, and carve coats of arms in it. This coal is dug in the park adjoining to *Beaufort*, belonging to *William Lord Paget*, about twenty, thirty or forty fathom deep, lying between other beds of a softer

kind, and is the best in *Staffordshire*, or any where else that he could learn, except that in *Lancashire*, which they say has no grain, and therefore not cleaving as this will do; upon which account 'tis preferr'd for making such utensils as above.

But the chief use of this *Staffordshire coal* is for firing, wherein they much observe the grain of the *coal*: for if they would have it burn flow, they lay it flat ways upon the fire; but if clear, 'tis set edge-wise, and then it burns as light as a candle.

The *Peacock-coal* dug at *Hanley-Green*, near *New Castle under line*, is much softer and of much more sensible plates, of about a quarter of an inch thick, which appear to the naked eye when the grain of the *cannel* will not: wherefore this is no more capable of *polliture* than common *coal*, yet is more gay to the sight, it most vividly representing the feathers in a peacock's train, and it burns swift, and therefore better for smiths than kitchen-fires:

Which are better supplied by the common *coal* of the country, especially that of *Wednesbury*, *Dudley* and *Sedgley* which some prefer to the *cannel* it self; the texture and other qualities thereof being such, viz. that it is a fat shining *coal*, having a pretty open *grain* lying seldom in a level with the *plane* of the *horizon*, but most times inclining to it, (according to which it cleaves into *blocks* at the discretion of the *workmen*) that it burns away with a sweet white flame, and into white ashes without cinder, as *New-castle-coal*; of this sort there is great plenty in all parts of the county, especially the places abovesaid, that most commonly there are twelve
or

of HUSBANDRY and TRADE. 153

or fourteen *collieries* in work, and twice as many out of work, within ten miles round, some of which afford two, three, four or five thousand runs yearly, the upper beds above the iron stone lying sometimes ten, eleven, twelve or fourteen yards thick, so that some acres have been sold for one hundred pound each, and one for one hundred and fifty pound; for from one shaft hath been drawn five hundred pounds worth of *coals*: and the wood of the country being greatly spent, they are thought fit for all offices, even to the *parlour* and *bed-chamber*.

Yours,

JOHN HOUGHTON, F. R. S.

FRIDAY, March 12. 169⁶/₇. NUM. CCXLI.

A preface recounting the heads of the most matters in all the volumes. Coal used in most mechanical professions. Coaks dry malt, how much coal boils salt and burns bricks. Several accounts of coals.

IN my first volume is the nature of *earth*, *water*, *air*, and *fire* with their effects and reason of many of their operations: in my second, *natural history* with the *taxes*, number of *acres*, *houses*, &c. in each county of *England*, with notes, particularly of *Yorkshire* and *Derbyshire*.

shure. In my third the doctrine of *fermentation*, history of *cyder* and *clay*: In my fourth, a continuation of *clay* and all its uses I could learn, with the history of *wheat*. In my fifth the history of *joint-stocks* and *kine*. In my sixth, I went on about *kine*, and have shewn the use and manufacture of most parts: also in order to *nutrition*, I have shewn the circulation of *blood*, with some reasons why it rises from low to high parts; and also the manner how bones and other parts grow: in my seventh I have carried on the history of *kine* in discourses upon *blood*, *butter*, *cheese*, *cows*, *cream*, *dung*, *milk*, *urine*, *whey*, and several particulars: in my eighth I have given an account of all the ships that came from abroad to the port of *London*, from *New-Year's-Day*, 1694. to *New-Year's-Day*, 1695. with the number from each Prince's territories: also of all the goods imported that year, and mention'd in the bills of entry, with the quantities imported from each place and all together. Upon these I have made some notes natural and political, as the advantage of a coalition with *Scotland*, the true case of a free trade, a regulated company, and a joynt-stock; with a method for mending the roads, &c. In my ninth, histories of imported *stone*, *glass*, *salt*, and a farther account of roads: in my tenth, a farther account of *salt*, the history of *nitre*, *gunpowder*, profits of the *Indian trade*, history of *vitriol*, *copperas*, *brimstone*, *okre*, *jett*, and *coal*, striving to make it the best account of trade, upon the best and most sure foot that ever has been yet published, and I could hear of: in this I shall go on to shew the farther advantage to be made of imported goods: and all this I will apply for the benefit of

of HUSBANDRY and TRADE. 155

of my country; not doubting but it may be made the richest and happiest the sun sees.

The coal mentioned in my last is not used only as common fire, but in most *mechanick professions* (except ironworks) that require the greatest expence of fewel; witness the *glass-houses*, *salt-works*, *brick-making* and *malting*; for they can *char* these coals, and make them into *coaks*, a description whereof I have given I think in my second volume, and with them they dry malt, but in the other cases they use the raw coal, and in the *Staffordshire salt-works* they spend two tuns to a drawing, and seven tuns for burning a clamp of 16000 bricks, but iron it will not yet manage.

This ingenious gentleman Dr. Plot gives an account of the manner how *coals* lie; the ways of working it; of damp; the coals profundity and different earths over; the reason for *coal-pits* taking of fire, with the signs and methods they take in finding and digging them, with the manner of clearing them from water; for all which I refer to the author himself.

But the chief place from whence *London* is furnished, is *Newcastle* upon the river *Tine* in the bishoprick of *Durham*, or thereabout, and from thence, as I have been lately inform'd, we have brought near 400000 chalder in a year to *London*, which employs and breeds up a great many seamen and ships, and might as many more, if what I have mentioned in my 4^o volume, about the destruction of wood, were but considered and put in execution, which might make the trade deserve the name given it by the seamen at *Wapping*, viz. the *Black-Indies*. I doubt not but it might be the foundation for our being too hard
at

156 *A COLLECTION for Improvement.*

at sea for all opposers. In several of these papers I have hinted this; and I presume when necessity urges, we shall make advantage of it. In the next expect more particulars from

Yours,

JOHN HOUGHTON, F. R. S.

FRIDAY, March 26. 1697. NUM. CCXLIII.

Arsenick, its description. Quantity imported 1694, and use. A metal what. Gold describ'd. Divers sorts of gold oar. One has an hundredth part gold.

MY last was observations from the quantities of coals spent; now comes in course *arsenick* or ratsbane, which Bishop *Wilkins* reckons among *earthy concretions not dissolvable*, being of a *gold colour*, of a *poisonous* nature sublimed, which makes it *white*, and as Mr. *Samuel Dale* says in his *pharmacologia*, is of a metallick substance, made white by subliming it with an equal part of common salt, and that it is of a *sharp* and *burning* taste.

Of this there was imported in the Year 1694 to *London* 900 lb. from *Germany*.

'Tis used in making medicines where 'tis rectified; for of it self 'tis esteem'd a great poison; and when taken, its antidote is *alkalizate salts*, or solutions of them. 'Tis also used to kill rats with;

of HUSBANDRY and TRADE. 157

with; but I cannot learn that 'tis used in wine, which some imagine, because they cannot else tell how it should be spent; (and they have heard talk of such matters) when as if they would mind political arithmetick, they would find that 'tis but 1152000 drachms, and there are reckoned in *England*, as in my great sheet of taxes, acres, houses, &c. about so many houses; and perhaps each may sometime or other use as much ratsbane in a year, which may take away the wonder of its consumption.

I come now to metal, which is a mineral, for the most part of a hard consistence, *close, ductil, fusil*, and distinguishable into *perfect*, viz. *natural* and *factitious*; and *imperfect* with reference to *metalline* kinds, and *recrementitious* parts.

By *natural* our bishop means, such as of themselves grow in the earth, without any kind of mixture or other help by the art of men.

These are either more rare and precious; as *gold, silver, tin, copper*.

Or most base and common; as *lead* and *iron*.

Gold is my next subject, which is of a *yellowish* colour, not growing in any particular mines, where 'tis imbas'd with any drossy mixture; but found pure, either in small *sands* or *rocky* branches.

But Dr. *Grew* tells us, that in the repository of the *Royal Society* at *Gresham College*, there is *gold oar* of *Herngrunt*, holding silver, and consisting of sparks of a shining gold colour, together with some black ones alternately immers'd in a white and pretty hard stone.

Gold oar of *Cremnitz*, one white and semiprecipuous, another blackish, not much unlike some flints. The others mixed of both, all so hard as to write upon glass.

That

158 *A COLLECTION for Improvement*

That with black spots in white is accounted the best. In 100 lb. weight of oar is contained about one ounce of gold, holding one third part of silver. In this mine sometimes are found pieces of pure virgin gold; of some called *obrizum* qu. *ophrysium*, like that of *ophir*.

Of several particulars of the working here, and of separating the gold from the oar, with the engines, &c. See Dr. *Brown's* travels.

There is *golden sand* from the river *Tagus*. 'Tis very fine and ponderous, consisting of grains of a reddish iron colour mix'd with black.

Yours,

JOHN HOUGHTON, F. R. S.



FRIDAY, April 2. 1697. NUM. CCXLIV.

Grain gold, Conimbria sand, the ductility of gold. Rock-gold. *It's probable gold is as plentiful as copper or tin.* Solomon's gold. *Great plenty in the East-Indies, West-Indies and Guinea.*

IN my last I gave an account of gold, and of some sorts of ores in Gresham-College.

There is also grain-gold or golden sand from the Danube. Very fine as the former, consisting mostly of black grains, wherewith are mixed some of a pure gold colour, in the proportion of about one to twenty.

Sand out of a river near Conimbria, in which are some few sparks of gold.

Gold hath the least variety of regular figure in the oar of any metal, because more solid, and therefore less wanton than the rest.

The ductility of gold is admirable; one grain in leaves is extended to above fifty inches square; and one ounce employed in gilding small hair wire, will be extended to almost one hundred miles in length, as Mr Boyle hath observed.

George Bohun, Esq; in Spittle-fields, hath a curious piece of rock gold.

The uses of gold are infinite. Gallienus the emperor powdered his hair with the dust of it; and Caligula set forth notable games in the circus, being strewed over with vermilion and dust of gold: and Nero being to try a match of chariot-driving,

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158 *A COLLECTION for Improvement*

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M

driving, caused to be strewed over with dust of *gold* the *Arena* or place below the amphitheatre, in which their games were exhibited, and was wont to be strewed with sand to suck up the blood spilt there.

Of *gold* there is a great quantity in the world, whether of *tin* or *copper* there be more I can't say.

On the twenty ninth of *January* 1683, in N^o 5 of my second quarto volume, I published an offer to make it appear that it is in the interest of the subjects of *England*, and much for the improvement of *husbandry* and *trade*, plentifully to supply their King, in a letter to *Roger L'Estrange*, Esq; there I shewed that *David* left *Solomon* one hundred thousand talents of gold, and three thousand talents more of the gold of *ophir*; and the people gave five thousand talents and ten thousand drams; and *Solomon* made two hundred targets of beaten gold, with six hundred shekels to a target; and three hundred shields, with three hundred shekels of gold to a shield; and he over-laid a great throne of ivory with pure gold; and all his drinking vessels, and vessels of the house of the forest of *Lebanon*, were of pure gold, besides many parts of the temple, and the utensils were of pure gold.

The *Mogul* is reported to have great tanks of it; and what vast quantities are in *China* and *Japan*, who can tell? And I am told there is plenty in *Borneo*.

What mighty quantities have the *Spaniard* brought from the *West-Indies*; and Mr. *Ogilby* in his *America* tells us, that one of the Emperors gave for his ransom of *gold* of above sixty foot long, seven foot high, and the breadth is not mentioned; and his brother had far greater treasures.

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We know little yet of the gold of *Guinea*: we seem to have only a few washings from the mountains, when for ought we know, they have mighty mines of it, from a consideration of which perhaps some may be of my mind.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, April 9. 1697.

NUM. CCXLV.

The wealth of some Romans and their great expence. Gold found in Scotland and England. Erckern's account of gold.

W Ithout doubt in time of the old *Romans* Gold was nothing known, to what it has been since; but then the wealth of some of the *Romans* was very great; and I suppose their cash chiefly *gold*; and particularly Dr. *Hakewell* in his apology tells us, that *Cecilius Claudius*, though he had sustained exceeding loss by the civil wars, yet left beside four thousand one hundred and sixteen slaves, three thousand six hundred yoke of oxen, seven hundred twenty five thousand of other cattle, in ready coin sixty millions of sesterces, besides a very great sum for funeral charges, which, according to my table of sesterces, amounts to four hundred sixty eight thousand seven hundred and fifty pound sterling. And *Seneca* the philosopher gathered in four years space two million three hundred forty three thousand seven hundred and fifty of our pounds,

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beside

beside which he had in the country goodly farms and in the city spacious gardens.

The amphitheatre at *Rome* began by *Vespasian* and finished by *Titus*, was reared with rivers of treasure poured out. It contained only on the steps sufficient and easy seats for eighty seven thousand; and the vacancies might well contain ten or twenty thousand more. This mighty building *Julius Cæsar* made furniture for of silver, and *C. Antonius* sometimes of gold. *Nero* covered not only the stage, but the whole theatre with gold. All the instruments then used, and furniture thereof were likewise gilded; and the veil or curtain that hung to cover them from the sun, was all of purple, embroidered with stars of gold.

Camden in his history of *Scotland* says, that near the head of the *Cluyde* in *Crawford-moor* among the wastes, certain husbandmen, after violent rains, found a sort of shavings of gold; and *Sir Robert Sibbald* in his *Scotia Illustrata* about metals says, that gold is frequently found in *Scotland*, not only in small fragments, but in pieces that weigh some ounces; and he himself saw a piece weighing two drams and a half, found in the unoccupied parts of *Crawford*.

Gerard Malines in his *Lex Mercatoria* saith, that *Sir. Bevis Bulmer* brought out of *Scotland* some aurum obrison or gold that needed no refining, found in the sands of the rivers near to the gold mines of *Crawford-moor*, which was above twenty two carrats fine, and better than the *Fr. crown gold*. He saw eighteen ounces of it in big grains, some like pease found out by the shepherds; some other gold hath been found in *Scotland*, within a white spar near the superficies of the earth, as pure as angel gold, holding but half a grain of alloy.

of HUSBANDRY and TRADE. 161

alloy. He also saw the like *spar* of gold at *Brickel* hill near *Spilsby* by *Lincoln*.

Sir *John Pettus* in his translation of *Lazarus Erckern*, tells us that no gold oar hath gold only of it self, without other incorporated metals, except it be *apparent*, and the same gold thus found, is not wholly *pure* and *clean*; but commonly *silvery*, although one more than the other.

Fair gold found thus *intermix'd*, or commonly *standing* in a whitish *flint*, and sometimes in a blue and yellow *horn-stone*, and also in a blue *shiffer streamy* and yellow iron, but very small and flaming with gold: this being ground and washed, there comes out a fair and high *duke-gold*, which otherwise is scarce seen in the *flint*.

All *goldish oars* (which are commonly *sandy*) have good *duke-gold*.

Sometimes with the digged gold (which lies in flints) there breaks a *small grey spiffy oar*, which after its colour is called *iron-man*, which is not only rich in gold, but is also *silvery*, therefore not to be compared to the other digged gold, which standeth in flints.

There are many *gold-flints*, which have more *silver* than gold; likewise some very *coppery* and *silvery*; the *silver* of it is also rich in gold; as also some white flints, which have no *copper*, and but little *silver*, are *goldy*; but the flints which are *coppery*, and whose *silver* hath gold, are found commonly with small flints *intermix'd*. He also gives a large account about its refining; but to him I refer you.

Yours, &c.

JOHN HOUGHTON; F. R. S.
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 FRIDAY, April 24. 1697. NUM. CCXLVI.

What gold was imported Anno 1694. Silver, what it is. How much was imported 1694. From Spain comes the great proportions. Uses of silver. The reason of its plenty. Prohibition of its exportation will do a little good. The nature of exchange. My proposal for encrease of silver.

OF Gold there was imported anno 1694, from *England* (I suppose some other place where they were imported before they came to *London*) 1150 leaves; and from *Germany* 81 books of leaf-gold. From *Holland* 36 l. of gold and silver thread. From *Germany* of counterfeit gold and silver 118. l. and 673 l. of gold and silver counterfeit thread, and 14000 gold and silver shells. From *Holland* 25 books of counterfeit leaf-gold.

The next metal to gold is *silver*, which bishop *Wilkins* says is a mineral of a hard consistence, close, ductil and fusil, of the perfect natural kind, or such as of it self grows in the Earth, without any other mixture, or other help by the art of men, and it is of the more rare and precious sort, of a whitish colour, and next in value to gold, not subject to rust, and of a pleasant sound.

Of this there was imported in the year 1694 from *Germany* by the name of *silver* oz. 15. of white plate from *Sweden* oz. 247. from *Germany* oz. 687. from *Holland* oz. 20; in all oz. 954.
Of

of HUSBANDRY and TRADE. 163

Of gilded plate from *Sweden* oz. 102. from *Germany* oz. 135. The whole is oz. 1206.

All this amounts but to a small sum; well fares it with *England* when *Spain* thrives; for thence uses to come our great proportions of *Silver*.

Silver is put to a great many uses in physick; but 'tis chiefly used in *plate* and *coin*; and countries generally reckon their wealth by a plenty or scarcity of them; and the reason of their plenty is, when from *foreign Countries* into *English* ships, or from *foreign* ships into *English* possessions less other goods comes in value than *English* goods are exported either into the foreign country or foreign ships: but this is not the *reason* of particular countries taking ours or sending us their *silver*: For *Holland* may send us 100000 *l.* when we carry to *India* 150000 *l.*

A great many people in all nations study how to encrease a quantity of *silver*: some think that a prohibition to its exportation, or a duty upon it, if exported, will do; but they are mistaken: for if I owe a man money and have not goods enough to pay, I must pay *silver* at a certain rate, by the ounce, tho' it cost me three or four pence the ounce more; and there are *easy ways* for its exportation: and suppose it should be *catch'd*, yet tho' he be half *undone* who would have sent it; yet he must still find way to send more to satisfy his creditor, or else he must be *undone* quite: and if it should be paid by *exchange* from another *country*, yet that will hinder so much coming hither from thence, or so much goods as would by re-exportation pay the debt; or supply us while we save some other merchandize to do it.

If I may throw in my thoughts how to en-

crease silver in this *land*, one way should be, instead of prohibiting the use of *plate*, to encourage it by fashion in the highest degree, which would at present make our coin more *scarce*; which would make bullion of more value, or at least, our goods sell cheaper, which would cause all our neighbours to bring their bullion hither; because here they would make the best *advantage* of it, and wherever there is great occasion for a commodity, there will the commodity come; and if the selling our goods cheap will cause a great exportation, that will *enbance* them, and *encourage* there a greater product: and if we still shall want *plate*, we still shall encrease materials to buy it with: for goods will grow *ad infinitum*. Beside, this will set the wheel of *trade* at work, and make a great many folk handle more money; which *pleases* them tho' they pay it *away* as fast as they receive it. If any who can, will give a fair *answer* to this proposal, they will oblige their humble servant,

JOHN HOUGHTON, *F. R. S.*

FRIDAY, *April 23.* 1697. NUM. CCXLVII.

Divers sorts of silver Oars in Gresham-college.

MY last had several notes about silver. Furthermore Dr. Grew tells us, that at *Gresham-college* is pure *silver*, naturally branched in the mine, from a silver mine in *Swecia*. Some of the branches are blackish, being tarnished; the rest of a clear *silver* colour. Some pieces of a white *spar*, dissoluble with spirit of *nitre*, stick to them.

A piece

of HUSBANDRY and TRADE. 165

A piece of *capillary silver*, or with smaller branches, also from the mine, with a kind of white rhombick spar growing to it.

Plated silver from the mine. It lies in thin plates, of a clear silver colour between the flakes; or in the grain of a hard white Stone. The several plates are curiously wrought with *Stiriae*, which obliquely discussate each other, and make their impression all along upon the stone. This stone is insensible of *acids*. In some places the silver also lies rude in a black oar.

Pure *native silver flak'd*; or, as it were, the silver broken into several thin Pieces lying also in the grain of a white *spar*, but dissoluble with spirit of *nitre*.

Thick plated-silver from the mine; with a mixture also of crude *silver oar*, both in a white Stone, dissoluble with spirit of *nitre*.

White silver oar, or of a silver colour from *Cremnitz in Hungary*. There are also some parts of black oar mix'd with it, and some *Cinnabar*; partly of a scarlet or vermilion colour, and partly of the *lapis hæmatites*.

Another piece of *white silver oar*, growing in a white stone, having a blackish cast in some places, with the hardness of a gem.

Yellow silver oar, or near the colour of gold, from *Koteenberge in Bohemia*. 'Tis granulated in a hard white stone. In some parts also blackish.

Another piece, rather of the colour of copper, from the same place. It grows in a hard, black and white stone.

Blue silver oar, from the silver-mine of *Berre Ferris*: not granulated but flaked. In some positions especially of a curious blue, like that of *chicory-flower*, or some blue glass; but much fairer.

166 *A COLLECTION for improvement*

er. Some yellow mundick also, with pure *silver oar*, with *Cinnabar*.

Green silver oar; The colour is somewhat obscure; but lies not only in the surface, but inward parts of the *oar*. Here are growing to it some of the *lapis Armenius* and yellow *okre*.

Black silver oar, for the most part granulated, from the silver mine in *Schemnitz*. This sort is the best, an hundred pound of which yields from an ounce of silver to twenty ounces. Some hath yielded half *silver*. Most of it holds some *gold*; the best one eighth part in proportion to the *silver*.

Grogunion oar; also black and granulated. It holds 50 *l. Sterling per tun*.

Cumsumlock oar, black, and most of it granulated, immersed in a blackish stone, dispersed throughout. It holds 28 *l. Sterling per Tun*. It runs in *veins* or *layers*, rather grained than flaked, together with *yellow mundick*, between two sorts of *beds*; one of whitish clay, the other of brown Stone.

A black and flaked silver oar, with some pieces of the *lapis hematites* growing to it.

Another piece flaked, from the forest of *Cre*, not far from *St. Veit* in *Carinthia*; with some adhering *Cinnabar* of a brown purple.

Black flaked silver oar from *Freyberge* in *Misnia*. Here are two pieces, one simple, the other mixed with white *oar* and *cinnabar*.

There is no end of the wonders of God's making.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRI-

FRIDAY, April 30. 1696. NUM. CCXLVIII.

More sorts of silver. Preparations of silver. Silver in England: Dr. Brown. Erckern's catalogue of ores, and account of assaying them. Of weights.

IN my last I gave you some account of *silver* ores in *Gresham-college*. There are some more, viz.

The *scorium* of the *Freybergick silver* ore. Porous, of a blackish glossy colour and brittle, as if it were glass of silver.

Black flaked *silver* ore from *Kottenburgh*.

The like from *Crummuſwith* rock. It runs in veins through a bluish grey stone, together with a white, hard and granulated *spar*. 'Tis also immerſed in grain in the grey stone. Both stones are ſo hard as to cut glaſs.

Cumſumlock ore, holding 20 l. ſterling per tun. 'Tis much like that of *Crummuſwith*.

Another like ore from *Cornwall* which grows together with *mundick* and green and yellow *spar*. Black and ſmall flaked *silver* ores from the ſame place. 'Tis immerſed in a ſlate, with yellow *mundick*.

A piece of black flaked *silver* ore, growing to a very hard *spar*, white within, and reddiſh without, and incruſted with ſparry gains, not much bigger than *poppy-seeds*.

Another piece with red *Cinnabar* growing to it.

A large piece of *silver* ore with *mundick*, running

168 A COLLECTION for Improvement

ning between beds of white, yellow, and green spar: the white so hard as to cut glass. The other two soft. The ore runs in a vein obliquely, so as to make an angle; by which the underlying or dipping of a load, may be well conceived.

The preparations of silver are made in most of those forms, as of gold, and described by the same authors. Goldsmiths sometimes give a silver wash to copper, with that which is called *Oleum Lunæ*. Solder (from the *italick*, *soldatura*) of gold is made of silver and half so much brass. Painters make a pure blue hereof with *sal armoniack*. Of the silver mines in *Mexico*, and the way of separating the silver from the oar, see the *Phil. Transf.* N. 41. and of the art of refining, N. 142.

Dr. Plot in his history of *Oxfordshire*, Ch. 6. Par. 62. speaks of a silver mine in that country, and from Mr. Webster he says a silver mine has been in *England* yielding 60*l.* per tun. And in his history of *Staffordshire*, Ch. 5. Par. 19, &c. he tells of silver ores shooting into divers figures.

Dr. Brown in his brief account of some travels in *Hungary*, &c. tells of their gold, silver, copper, and other mines.

Lazarus Erckern in *Fleta minor* has given a large account about silver, with its refining and other matters that belong to it. I shall give the heads and refer you to the book it self. And in his second chapter he tells how silver ores are distinctly known; particularly of the difference in assaying ores, and of the several sorts of silver ores; as of glassy, white, goldish, glittering, or bismutick, flote, azure, or mountain-green, flinty, blanch, cobolt, mispeckle, or speckle. Of glimmer, wolferan, talk, cat-silver and sparking. Of spelter

of HUSBANDRY and TRADE. 169

or *spizy*, *spady*, *slacks*, and *copper-stone ores*, and the ways of assaying them. He also tells how the assay-ovens to prove silver and other metals are to be prepared, and also how *muffles*, *bottom-plates*, *tests*, and other small potters works are to be made for assays. Also how *copels* may be made firm and good, and so as the tryals will not leap or sparkle. How good *clar* is made for *copels*, how lead-glass is made. He treats of the weights that belong to the proving of silver, how all *silver ores* are to be tryed and assayed, how *poor silver ores* are assayed: also *muddy water* coming from springs of silver, and some others you shall have in my next with all brevity imaginable. And although some will not care for this sort of knowledge, yet 'tis useful to a great many others; and at one time or other I would please all.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, May 7. 1697. NUM. CCXLIX.

Erckern's farther account of working silver.
The reason of names for money. Silver
in England, Scotland and Ireland, &c.
Silver-coin. *Deficiencies in it and in its
mending.*

I N my last I gave some account of *silver oars*
and its *refining*. *Erckern* farther tells how true
lead-grain is to be drawn from the assay; for the
poorest lead is not without silver: how flake
and

and copper-stone are to be tryed for silver: to assay horn-work and copper-lech and melted speize: how black copper is to be melted and cast into ingots: to assay bell-metal of silver: how old silver plate or coins are to be granulated: how to granulate silver out of a kiln: how the granulated silver is to be assayed for fine silver: how coined money of great or small sorts may be assayed: how burnt silver pieces and plates are to be cut out for assays: how touch or proof needles for silver are to be made: how melted metals must be cut out and assayed for silver: how tin is to be assayed for silver: how to separate iron and steel from silver: how blink or unclean silver is to be burnt clean, and how tests for it are to be made: how to burn silver under the muffle: how copper is to be assayed for fine silver: to separate silver from tin: how to drive all sorts of silver that they be dest, smooth and fine: how to boil copper from the pagment or old silver in coined money, or from thin plates of silver: how good proof-balances and weights are to be made.

Mr. *Malines* in his *Lex Mercatoria* tells us, that *moneta* is à *monendo* (to shew the name of the prince) and *pecunia* from *pecude* (cattle:) *nummus* à *numerando* (numbering;) and that the first silver money coyn'd was the 484th year of the foundation of *Rome*; and the coins of gold were sixty two years after: and since the foundation of *Rome* to this day according to his reckoning is 2448 years.

He says, we have abundance of silver mines in *England*; particularly that the mines of *Muggleswicke* and *Wardal* at *Duresme* contained six or eight ounces of silver in the hundred weight, *Slaithborn* in *Lancashire* four ounces, *Combmartin* in *Cornwall* ten ounces: for every pound did produce above two penny-weights of silver: and just

of HUSBANDRY and TRADE. 171

just now came one to tell me, that out of Sir *Carberry Price's* lead in *Wales* his friend got nineteen grains from a pound; and he talks of two penny-weight may be gotten, if he had skilful folk.

He also tells of rich mines in *Scotland* and *Ireland*, and some fancy brave things in our *Western Indies*.

Relating to silver comes in *coin*, of which of late has been many treatises: and truly Sir *William Petty's* and Mr. *Lock's* were very ingenious; like Philosophers they studied the nature of the thing.

Now our money is milled for finery and security; and 'tis ordered be of full weight and fineness: But I am told that a good crown-piece may be scooped, wash'd, filed, have the edge cut off, and (some being taken away) edged and lettered again, and bad ones cast and plated. If these cannot be prevented, I doubt time will fill us again with bad money. We find hanging does no good; neither will punishment hinder its melting down or carrying abroad: nothing but interest will mend these things; and can we imagine that who will venture his life in stealing half a crown, will not be as hardy to cull and debase the heavy money so long as lighter will pass? It's a grief so many people should be hanged. *Principiis obsta*; to prevent mischief, is better than punishment; but this will spoil the trade of *Newgate*: And I have hinted many things, that tho' this age can't answer, another may consider. Next *Friday* expect some account about raising the denomination of money from

Yours, &c.

JOHN HOUGHTON, F. R. S.
FRI.

FRIDAY, May 14. 1696.

NUM. CCL

Raising the denomination of money no use to a nation, and why. Tin, what. When tin was first in Germany. Tin in Devonshire. Stannary laws. Where tin is coined. Post-coinage. Stannaries jurisdiction restrained. Stannators consent to laws.

LAST week was about debasing money. Now for its denomination, which some are for raising; but what good can that do a nation? Will any give more for an ounce of silver than an ounce of silver, without other consideration? Will a foreigner who lays out an ounce of silver abroad to buy a commodity, and sells that commodity here now for six shillings (an advance of 20 per cent.) will he then sell for six shillings, when they weigh but one OUNCE? Where will his profit and charge be? But if not, then we must pay dearer for foreign goods in proportion to the raising; and if so, what good will it do us? I know, when a guinea was thirty shillings, it seemed to make some trade; for every one push'd them off. But those who possessed them at last, lost what others saved; and they went abroad no otherwise than as *bullion*. And when the *French* king raises his money with design to lower it again, 'tis the same thing as a tax upon his subjects, only it puts trade into confusion.

The next metal to silver is *tin*; which Bishop *Wilkins* says is a mineral of a hard consistence;
close,

of HUSBANDRY and TRADE. 173

close, ductil, and fusil, of the perfect natural kind, of a middle value, whitish colour, and *more soft* consistence than *silver*.

Of this, simply of it self. I find none imported, our own being the chief country in the world for it. Dr. *Peter Heylin* says, the mines of *tin* are most considerable in *Cornwall*, where they dig *tin* not much inferiour to silver in fineness; a commodity which brought great wealth to *England* in former times, the art of making it being not elsewhere known in *Europe*, till one of the *tin-workers* flying out of *England* for a murder, passed into *Germany* Anno 1240. and there discovered some *tin mines* in *Misnia*, not known before, and sets on foot that trade amongst them to the great prejudice of the Earls of *Cornwall*, who had before the sole monopoly of that useful metal.

But whether the Earl's power reach'd into *Devonshire*, I know not; but Mr. *Camden* in pag. 18. and 19. of his *Britannia*, says, that though there be but little or no *tin* made in *Devonshire*, yet in King *John's* time there was more found than in *Cornwall*: for the coinage of *Devonshire* was then farmed for 100 *l. per annum*, when *Cornwall* yielded but a hundred marks. And now the King pays the tenth of that, viz. 16 *l.* 13 *s.* 4 *d.* to the Bishop of *Exeter*.

The addition to *Camden* in pag. 37, tells of four *stannaries* or jurisdictions in *Devon*, with as many *Stannary-Courts*, and the towns of coinage. viz. *Tavistoke*, *Ashburton*, and *Chagford*; which gives reason to believe there were great quantities. There was a volume of *Stannary Laws* in *Q. Eliz.* time, printed; and I think that or some other like not long since, by my very good friend Mr. *John Beaumont* of little *Easton* near *Wells*;

N

but

but now *Cornwall* has almost the whole trade: As also my ingenious good friend Mr. *John White* of *Butterly* near *Tiverton* in *Devonshire* writes me.

Mr. *Camden* also says, that all the *tin*, after 'tis wrought, is to be brought to one of the four towns to be stamped, &c. The stamp is the seal of the *Duchy* and the towns *Liskeard*, *Lostwithiel*, *Truro* and *Helfton*; but since Mr. *Camden's* time, *Pensans* is made a coinage-town. *Bodmyn* once was.

There are two other coinages called by the tinner's *post-coinages*; for which they pay four pence for every hundred weight. These at *Lady-day* and *Christmas*. The King or Duke has the right of *pre-emption*.

In the fiftieth of *Edward* the third an explanation of the tinner's charters of the two counties was made by act of parliament, which was confirmed and the *Stannaries* jurisdiction farther restrained by a statute in the 17th C. 1.

Henry the seventh granted the tinner's a charter, that no law relating to them should be made without the consent of twenty four *Stannators*, and those to be chosen by the mayor and council of a borough in the four divisions, six out of each.

Yours

JOHN HOUGHTON, F. R. S.

FRI.

FRIDAY, May 21. 1696.

NUM. CCLI.

Tin mines *few except Germany and England. English the best in the world. Some gold in it. How much made yearly. Tothonaag. Tin stone described. Tin lightest of metals. How to manage Tin stone. Divers sorts of tin.*

BEside what *Heylin* and *Camden* affirm, as in my last, *Mr. Malines*, in his *Lex Mercatoria*, says, that *tin mines* are but few in all countries, and in *Germany* only found somewhat plentiful, but the *tin* is blackish and corrupt; so that our English *tin* in *Devonshire* and *Cornwall* is the only *tin* of all the world, which containeth four ounces of gold in a thousand, whereof there is some (I suppose he means somewhat about) twelve hundred thousand made yearly. It hath been sold for many years at an under-value; but his Majesty hath, by way of pre-emption, advanced the price thereof which belongeth to the Dukes of *Cornwal*. This he writ in 1622. as it is to be seen by the date of the epistle to the reader. But since there is sometimes brought a sort of *tin* from *India*, when ours is very dear. I think they call it *tothonaag*: whereof our *tinnors* think it their interest to keep it tolerably low.

Lazarus Erckern says, that *Zwitter* or *tin-stone*, whereof *tin* is made, is heavy oar; yet the metal which it produceth is the lightest of all metals. This *Zwitter* is to be known by its brown colour, which inclines a little to yellow; yet the rich *Zwitter*s are black, and of fine growth, and so smooth as if they were polished, and very rich

176 *A COLLECTION for Improvement*

in *tin*; yet sometimes the *Zwitter* are found in another form, like *iron stone*, or a pointed *woolferan ore* (which the old miners have not known) therefore 'tis needful to prove the *Zwitter* with diligence, whether it be *tin stone* or not, and whether it yields much or little, that the *mine-workers* may the better know what to do.

The *tin stone* must not only be burnt, but purify'd clean before the melting, else it yields not so much *tin*.

Yet every *tin-mine work* hath a singular manner to prepare the *Zwitter* or *tin stone*.

He farther shews how to prove *tin stone* for *tin*, how to try *tin stone* in the little ovens, how to beat and prepare the *Zwitter*, gives an instruction for *tin-stone-work*, and to prove *tin* additions.

Dr. Grew in his *Museum* of the *Royal Society* says, there is at *Gresham-college* a piece of pure *tin*, refined in the furnace. Pure *tin* native, or from the mine. It lies as it were in bright drops in a brown stone. Crude *tin* powdered, consisting of shining black and iron-coloured grains. *Tin ore* holding *silver*. Fat *tin-lead* of a great grain, in a bluish clay; 'tis a cluster of chrystals like black glass. Another piece also very fat, but smaller grained; consisting rather of sparks. A *Sboad*, a fat *tin stone* so called, of an iron colour, with some gloss where it is broken, very ponderous. A sort of *tin ore* with its *grew*. That is a congeries of chrystals or sparks of *spar* of the bigness of bay-salt, and of a brown shining colour, immersed therein. They are so hard as to cut glass. *Tin ore* consisting of extreme small black sparks or grains, immersed in a green and yellow grit. *Tin ore* of an okre-colour, with a mixture of black shining sparks.

Yours
JOHN HOUGHTON, F. R. S.
FRI-

FRIDAY, May 28. 1697. NUM. CCLII.

More tin ores. Uses of tin, particularly in tinning metals.

BESIDE what I gave you last week, there are in *Gresham-college* a specimen of *grain tin-ore* of several colours, viz. blackish, brownish, purplish, reddish and yellow. So good that they need little or no preparation, by stamping or dressing for blowing: Neither is there any considerable waste in melting.

A *slag* remaining in the bottom of the *tin-float*. Of a bright colour next to silver, yet contains mostly *iron*, which appear'd by applying the load-stone to it. Dr. *Stall*, a German chymist, affirm'd the *Dutchmen* made good *spelter* of it.

Scum taken from melted *tin*. Of a blackish brown, with some sparks of metal. It's near as heavy as pure *tin*.

Chimney-tin forc'd up from the herd. 'Tis black, shining and heavy, almost like very fine black sand.

A metalline *flat* from the *tin-mines*.

There are large accounts of *tin-mines* in *Cornwall* and *Devonshire* in the Philosophical Transactions.

Tin mixed with *copper* in proportion, as two to seven, makes metal for bells, organ-pipes, &c. If the proportion be much under, 'twill be too brittle. The metal used for *speculums* and *con-caves* is likewise a mixture of *tin* and *copper*. Of *tin* with *lead* and the *marcasite* of *antimony*, of

each one eighth part is made one sort of *printing letters*. Of this metal is made that sort of *ceruss*, call'd *Spanish white*; one of the best, used either by painters or women. *Stannum ustum*, the best preservative of the polish of *metallick concaves*, and the like. *Riverius* highly commends his *bezoardicum jovis* against malignant fevers. A mixture against the bitings of *mad dogs*, consisting chiefly of *mithridate*, and the filings of *tin* is much used and relied upon by some *huntsmen*. Thus far *Dr. Grew*.

Dr. Plot in his history of *Staffordshire*, chap. 9. par. 80. &c. He says, that at *Walsall* they make a great variety of iron wares; in perfecting of which they use a great deal of *tin*, which they superinduce over them, give a better lustre and preserve from rusting; and to prevent others from giving a taste of the metals to things boiled in them.

For performance whereof they use methods and materials proper for each metal, *viz.* For *iron* they melt in a pan *tin* and *yellow rosin*, which will swim above the *tin*, the thickness of a crown-piece; into which the wares being first soak'd in old sharp clarify'd *whay*, to cleanse them from all filth, and duly beated, and then dip'd into this mixture, and shaken about by mediation of the rosin, they become tinn'd all over. And for *tinning* smaller *brass* wares, they put them all together in an earthen pot, and heat them over the fire to a due proportion; then put in a suitable quantity of *tin*; and when 'tis melted they cast in some *sal armoniac* (by mediation whereof the *brass* admits the *tin*) which when shaken together, the work is finish'd, only they cast them immediately into a pan of cold water to wash the *feces* of the *sal armoniack*, and to cool them quickly

of HUSBANDRY and TRADE. 179

quickly to preserve their colour, which is not kept, if long in cooling.

Yours, &c.

JOHN HOUGHTON, F.R.S.

FRIDAY, June 4. 1697. NUM. CCLIII.

How they tin brass vessels and copper. How many tin plates imported in 1694. A proposal for tinning tin plates.

LAST week I told you how to *tin* small wares; but in *tinning* greater *brass vessels*, such as *pots, kettles, &c.* First, they give the vessel its due heat, then sprinkle the *sal armoniack* in dust all over it, then apply a rod of *tin* cold to it, (the vessel being hot enough to melt it down) which done in a proportionable quantity to the vessel, 'tis brush'd all over with hurds or combings of hemp (which licks not up the *tin* as any thing else will) and the work is finish'd.

In *tinning copper* they use the same methods, only instead of *sal armoniack* they use black rosin to unite the metals, with which they rub the vessel all over, and then apply the *tin*, and so proceed as above. That the operations are so, all the workmen know; but why these materials rather than other should perform these feats, is a question perhaps unproposed, much less determin'd.

Dr. Plot at the bottom of the aforesaid account, pretends to give some reasons for these things;

but to him I'll refer the reader, it being too nice for this place.

The *tin plates* with which we make our *tin vessels* are *iron plates*, I presume, *tin'd* over something like as above; but truly the exact way of doing them I know not; although a great many think it a failure in us not to have that manufacture here; for we abound in *iron*, and the *tin plates* we use are manufactur'd abroad with *tin* from us, and our neighbours supply us with a great plenty: For in the year 1694, there came to *London* from *England* (I suppose some other port they were imported to formerly) 42 barrels, from *Germany* 1318 barrels and 3 vats, and from *Holland* 6 barrels and 600 of single plates, from *Germany* 2700 double plates, and from the same place 751 single and double plates; in all, 2117 barrels, 3 vats, and 3300 plates, and I presume in times of peace comes many more. Had we this trade here 'twould make a great employment; but whether 'tis worth while for a Parliament to encourage it, or for private men to engage in it, I must leave for time to shew; altho' should we get good artists in this manufacture, set up sufficient works, then lay 20 s. an hundred more upon *tin* at coinage, and take it all off again at the exportation of *tin plates*, with a mark that could not be counterfeited; or to make a severe penalty for those should take the draw-back for any plates not made here: I say, could this be done, 'tis possible we might get this trade, and sell *tin plates* cheaper than all other folk; but if we shall see that this way will be too dear for those that use it to *tin vessels* with, then we may lower the coinage-duty, and give some other encouragement for the making of *tin plates*; but had

of HUSBANDRY and TRADE. 181

had I power, I would by this or some other way get the manufacture settled here.

Yours

JOHN HOUGHTON, F. R. S.

FRIDAY, June 11. 1697. NUM. CCLIV.

Tinners complaint. *Price of tin in old time. Coining at blowing-house thought an advantage. The diet of some tanners. Pewter how made. How pewter comes to be used for grain-colours.*

SINCE I have been on this history of *tin*, a certain author has presented me with a book, entituled *the tanners grievances*; which he thinks chiefly arises from not having the *tin* coined weekly, whereby they may manage their money as others do, buy their necessaries at best hand, and not be forc'd to run in debt, and through that necessity sell their *tin*, each quarterly coinage for any thing the money'd merchants will give them. This, they say, will encrease quantities and price too; but whether 'twill or no (altho' they pretend a precedent for it) I leave to the judgment of others.

He says, that in the reign of King *Charles* the First, the quantities of *tin* were very inconsiderable, comparatively with succeeding times, and yet the price was but forty odd shillings in the time of the last farmers; but when the *tanners* were releas'd of that bondage, as he calls it, that
is,

*i*s, had liberty to sell daily, the price did presently advance to three pounds, which encourag'd hands to get more *tin*, and yet the price grew till it came to six pounds odd money the hundred.

But when in King *Charles* the second's time, the half yearly coinage returned, the price abated, till it came again to forty odd shillings.

He also affirms, that the *metal* may be kept as pure, nay, purer by being coined at the *blowing house*, than elsewhere; and if it be coined there, 'twill prevent running it, and so save the King's duty.

He also proposes some remedy about the election, about their Parliament (for their great court is so called.) And if his proposals shall be granted, he says the *tanners* will be oblig'd to augment the King's revenue, by paying merchants weight, viz. six score and two, and preventing its running without paying the King's duty.

He tells us, the *tanners* are reduc'd to hard livings.

He also complains of the charge of suits in their stannary-courts.

If these things be true, there needs amendment.

The great use of *tin* here in *England*, is to make *pewter* with, which is a mixture of 3, 4, 5, or 6 pound of *copper* to 100 weight of *tin*; and the finer the *tin*, the more *copper*: To take off some ill colour, are sometimes added a few ounces of *spelter*, and of this sort of mixture call'd *sad-ware*, are made *dishes* and *plates*; but the hollow ware, viz. *pots* for measure, *chamber-pots*, &c. have an allay of *lead* in them, and are sold cheaper.

This *pewter* is light and porous; therefore the *sad-ware pewter* is hammer'd much to make it close and serviceable; and from it are made a great variety of utensils, and particularly some
dyers

of HUSBANDRY and TRADE. 183

dyers vats, especially at *Bow* for *grain colours*, the knowledge whereof (I am told by one should know) came thus.

The *Dutch*, like thrifty folk, save every thing, and among the rest, one sav'd some old *pewter*, and boiling of colours which would not hit, he, by some accident, put in some old *pewter*, which presently improv'd the colour, and so they have made *pewter vats* since.

And thus much for *Tin*. I am

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, June 18. 1697. NUM. CCLV.

Copper the first material of money. How much imported 1694, and how much brass. We have copper-mines in several places.

IN my last I ended the history of *tin*. Now for *copper*; which bishop *Wilkins* tells us is a natural metal, growing in the earth without any kind of mixture, or other help by the art of men; and 'tis of the middle value, of a reddish colour, and the first material of money. Of this in the year 1694. was imported from *Barbary* 350 hundred; from *England* (I suppose some port where 'twas formerly imported) 98 hundred; from *Sweden* 291 hundred; from *Germany* 706 hundred and 631.; from *Holland* 39 hundred; from *Spain* 259 hundred, and from *America* 5 hundred. Also from *England* 5 hundred

184 *A COLLECTION for Improvement*

dred of copper coin; from *Germany* 39 copper ingots; from *Holland* 12 books beaten copper, one ounce of copper-dust, and six copper lamps; in all 1663 hundred, 39 ingots, 12 books, 1 ounce and 6 lamps.

Moreover there was imported of brass made from copper, from *Germany* 28 hundred: *Virginal wire* 200 l. battry or kettles 14 hundred, and of *verdigrease* 90 l. From *Holland*, brass 23 l. Lamps 4; brass wares certain, thrice: brass wire certain, and thimbles 145000, and one barrel, besides 2046 hundred of battry.

Of this though they have no mines in *Holland*, yet the most of what's manufactur'd comes from thence. They are an industrious people, and for it ought to be applauded; and in time I hope we shall imitate them: For the beaten copper and lamps we may do as well as they: Also the wares, wire and thimbles; and if what historians of old, and the modern people say, we may out-do 'em: For *Camden* in his *Britannia*, pag. 821, and description of *Cumberland*, says, at *Newlands*, and other places near the river *Derwent*, some rich veins of copper, not without a mixture of gold and silver, were found in his age by *Tho. Thurland* and *Daniel Hotchfetter* a German of *Ausburg*, tho' discover'd a good while before; as appears from the cloffe rolls of *Henry* the third, Numb. 18. About these there was a memorable trial between *Queen Elizabeth* and *Thomas Percie*, Earl of *Northumberland*, and lord of the manor; but it appearing there were veins of gold and silver, it was carry'd in favour of the *Queen*; but it seems in *Cæsar's* time the *English* used imported copper; altho' our author says, we had enough to supply our selves, and export great quantities to our neighbours. In pag. 883. he also speaks of copper-mines at *Caudebeck*.
Mr.

of HUSBANDRY and TRADE. 185

Mr. Malines in his *Lex Mercatoria* says, *England* hath divers *copper mines*, at *Kenswicke* near *Scotland* were made some forty tuns yearly. Some mines of *copper oar* were found in *Yorkshire*, and our author saw excellent *copper oar* of some mines in *Staffordshire*, which was the best in *England*; and Mr. *Stonewell* assured him of great store of *oar*. Our author hath also seen good *oars* in the west of *England*.

Yours,

JOHN HOUGHTON, F. R. S.

FRIDAY, June 25. 1697. NUM. CCLVI.

Copper oars in *Staffordshire*. *The working thereof laid down, and how reviv'd in England. Five copper stocks. Honest stock-jobbing justified. Copper stocks have improv'd England greatly.*

I N my last I gave some account of *copper oars* in *England*. Dr. *Plot* in his history of *Staffordshire*, the 4th chapter and 28th paragraph, tells us of divers *copper oars* dug out of *Eaton-Hill* in the parish of *Wetton* belonging to the Earl of *Devon*. Also about *Beresford* near Mr. *Cotton's*, and at *Upper Elkston*, and some think at *Madely*, both in the lands of *John Offely, Esq;* but none were ever thought worth digging; but at *Eaton-Hill* where the mine was work'd several years by my Lord of *Devon*, Sir *Richard Fleetwood*,

wood, and some *Dutchmen*; but all left it off as not worth their while.

He learn'd that the veins lay from eight to fifty yards deep; but all dip'd *north-easterly*, that they broke the rocks with *gun-powder*, and got three sorts of oar, *viz.* a *black* the best, a *yellow* the worst, and a mixture of both, which they smelted at *Ellaston*, not far off, where they had mills, &c. for the purpose.

And thus, for ought I can learn, the *copper works* of *England* had like to have been given over, and were reviv'd only by necessity, the mother of invention: For our long peace before this war had made the *Londoners* and others very rich; but since this present war, our trade being interrupted, some ingenious, and some crafty men, drew others into joint-stocks, thereby to employ their money in some new *trades* at home; and among the rest, there were five stocks rais'd for the finding out of *copper*, which were called by the names of *Dockwra*, *Hern*, *Derby*, *Welsh* and *Cumberland*, and a great deal of money has been spent in the search to the prejudice not of a few; neither were they so much damaged by the search, as by the art of stock-jobbing, some men being over-cunning for the rest; altho' should buying and selling of shares (which is call'd *stock-jobbing*) be prohibited, there must be no *joint-stocks*, that is, *partnership*, even in fitting a ship to sea; for who will have a share, if to save his *life*, *estate*, or *freedom*, he might not part with it? there is nothing to be said but *caveat emptor*.

But however, whether people have or have not thriven by stocks, 'tis a plain case that *England* has, and particularly by the *copper stocks*; for *Dockwra's* stock alone produces, as I am inform'd, about 80 tun a year; and the rest, it's probable,

of HUSBANDRY and TRADE. 187

as much, both about 160 tun, which at 100*l*. the tun (and sometimes it has been sold at 120*l*.) amounts to 16000*l*. the year, which must hinder the importation of so much, and at 10*l*. the year a head, finds livelihoods for 1600 persons, beside what the turning it into *brass*, the making of *battr*y, *wire*, *pins*, and other manufacture causes. I remember that sometime since a Gentleman offered to lay me 100*l*. that in seven years time we should export more *copper* than *Sweden* should.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, July 2. 1697. NUM. CCLVII.

*Many Mines in England. Great store in Cornwall. Calcining with pit-coal. A proposal. Battr*y and wire made here as good as any where. How much wire made in a week. 'Twas made in 1649. of foreign copper. An account of Eckern's book of copper.

IN my last I gave account what quantities of *copper* are yearly produc'd in *England*; and if sufficient encouragement be given, much more may, for we have *mines* in divers counties; and, as I am inform'd, at *Trevascus* in *Cornwall*, where has been dug more than 1000 tuns of *oar*, there is one spot known of thirty two foot broad, eight foot deep, and how long none can tell.

We

We have lately found out the art of *calcining* the *oar* with reverberatory furnaces and *pit-coal*, and were there a law that *copper oar* might be under the same *customary allowances* to the lords of the soil, as those of *tin* and *lead* are, and were one company only allowed for fourteen years, or at least all the companies joined in one, on such terms as a set of men appointed by parliament should approve of, 'twould hinder all contention among themselves; and it's probable so *nourish* this child, as to make it, at the end of the fourteen years, *robust* and *strong* enough to shift for its self, and slight any should strive to oppose it.

The undertakers of these *copper works* have very good wills to establish this *copper-trade*; and in order thereto, beside the trade of *farthings* and *half-pence*, Mr. *Peter Dockwra*, that is comptroller of the *penny-post-office*, and some others with him, have began with *English copper*, the manufactory of *battrry*, such as kettles, &c. at *Esher* near *Kingston* in *Surrey*, upon *Molesey* river; and since, as more profitable for the kingdom, the manufactory of *wire*, for the great trade of *pin-making*; and they are the only *brass-wire* works of *England*, where are 24 *benches* drawing the same by *water-works*, and 'tis as good as any foreign, and now sold for above 8*l.* the hundred. They also finish 80 *rings* in a week, each containing one quarter of a hundred, in all twenty hundred or a tun weight.

'Tis true that this trade of *wire-making* was begun at *Esher* by one *Jacob Momma* and *Daniel Demetrius*, about the year 1649, but was then made with *rose copper* brought from *Sweden*.

Sir *John Pettus* in his *Fleta Minor*, or translation of *Lazarus Erckern*, tells us how to know
copper

of HUSBANDRY and TRADE. 189

copper oars; to make *crucibles* and *ovens*; to prove *copper*; to make *fluffs*; to prove soft and hard flowing *copping oar*; light *coppers*; also to prove *copper oar* from *copper stone*; to prove *melted copper*, *flinty copper* by *sulphur*, and *black copper* by *deft* or *smooth copper*; to prove whether *lead* be very *copperish*, with twelve instructions for an *Assayer*; twelve directions to separate *silver* from *copper*; thirteen additional instructions about good *copper*; six more about proving *fresh oar*, called *hard lead*; three more concerning *thornells*; six more concerning good and *deft coppers*; seven more about good *coppers*; nine rules for assaying the *regulus* of poor *black copper oar*, after the *Hungarian method*; seven more, and how the *intristrick* is to be performed; how *litharge* pieces are made; how *silver* is separated from *spizy* and unclean *black copper oars*; instructions to drive *lead* and *copper* from *silver*; of driving *keinstocks* and *thornells*; a singular way of *melting*, and how *copper* is made *brass*.

Yours &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, July 9. 1697. NUM. CCLVIII.

A mistake. How brass is made. Stones from St. Maloes. Divers proprieties. How wire is made on a battry.

IN my last concerning *copper* it should have been *William* instead of *Peter Dockwra*.

O

Now

190 *A COLLECTION for Improvement*

Now for the making of *brass* in *England*, which is compos'd with about two sevenths of *fine copper*, four sevenths of *lapis calaminaris*, and one seventh of *scruff*, which is old *plate brass*.

This put into pots containing ten or twelve pounds of metal each, and set in a furnace, where there is freedom of air at bottom, *melts* and *coagulates*, or joins in ten or twelve hours time into a new thing called *brass*. Then eight or ten of these small pots are poured into one larger; and when 'tis perfectly digested, and well scumm'd from the dross, 'tis then poured between two stones of a tun weight, or more each, which are elevated at one end for to make the metal fill the whole vacuity, and then 'tis set horizontal to cool, and thence comes out a plate of about seventy pounds weight.

These stones come from *St. Maloes* in *France*, and are scarce any where else to be had, and the great *brass works* at *Acon* or *Aix la Chapelle* are supplied thence; which shews how one part of the world is oblig'd to depend on the other, as *du Bartas* says,

*All's but an exchange, where briefly no man
Hath ought but his own. 'Tis trade makes all
things common.*

Agreeable hereto, I am inform'd, that the iron we draw silver and gold wire thro' is made at *Lyons*; the mill we flat it with by *Aldgate*, and the needles used in *stocking-frames* are made of iron from *Yorkshire*, and the like of these, for these purposes, can be had no where in the world beside.

The *plate* above-mentioned, when taken out, and design'd for *wire*, is cut into seven or eight slips,

of HUSBANDRY and TRADE. 191

flips, and then stretch'd in the *rolling-mill* by force of water (like the money-plates at the *Tower*) to what thickness desired, after several *nealings* to keep it soft, and make it pliable. This is cut into many long threads, and drawn thro' many holes in irons, to such sizes as desired; but the great quantities are used for making pins; and, as I hinted before, are made into rings of a quarter of a hundred weight.

The *battr*y is made by the plates taken from the stones, cut into rounds, and four or five, sometimes more, hammer'd together, sometimes with hammers of five hundred pound weight, and sometimes less; and they are beaten first flat, then rais'd up round into several hollow shapes, as women make pies, and so brought into that pass, as *battr*y comes into *England*; but this also is done by often *nealing*; and when handles and rings are put to them, they are made *kettles*, *sauce-pans*, and what not. I design next week a history of pins.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, July 16. 1697. NUM. CCLIX.

How brass-wire is brighten'd, drawn for Pins, streighten'd, pointed and headed. How pins heads are made, and pins whiten'd. Their papers and manner of sticking and making up. The sorts of pins. Their price. The charge of workmanship. The hands employ'd in 'em.

IN my last I promised the manner of making *pins of brass wire*, which take as follows.

I told you before how *wire* was made into rings of a quarter of a hundred weight. These are carried to the *starch-makers* or *distillers* to lie in their *sour wash*, till the rust be eat off, and they become bright.

After this every single wire is rub'd with smiths *scoria* or *scales*, and the pulp of rotten oranges, to make them more fine or clean.

This done, 'tis drawn to a *size*, that is, as near as can be, made all of a bigness, which is done in two, three, or four drawings.

Then a board is stuck with peggs; and between these the *wire* is drawn through to make it *streight*, and cut off at five or six yards in length, from which 'tis cut into pieces of six or eight inches, which are pointed at both ends, upon a mill made with *iron* and *steel*, and cut into transverse or thwart *notches*, then the points are cut off to the length of a pin, and *toties quoties*, or so long that it cannot be cut into pins any longer.

This

of HUSBANDRY and TRADE. 193

This done, they are *headed*, by taking up the *head* with the point, and pulling to the other end, and then put into a *treaddle* and *stamp'd*, which makes the head close and round.

The heads are *wire*, spun upon a *wire*; and when the inward *wire* is pull'd out, a little handful of the other are held together, and clipp'd so with shears as to sink a *pin's* head each clip from each wire.

When headed, they are *whiten'd* with *tin* and *argol*. The *tin* when melted with much stirring will crumble, and this, with *argol* boil'd in water with the pins, will make them in two or three hours become *white*; then they must be drain'd and dry'd, by tossing in a bag or barrel that has in it *bran* and *box-wood* dust.

Thus they are made, and afterwards papers, which are printed with the pin-maker's name and mark, are cut into breadths and lengths according to the bigness of the pins.

Of these a dishful is set out, and by handfuls they are tossed on a *tossing-row* (a thing made with pins something like a comb) to catch the heads all one way, from whence they are taken up in plates, set into a bar, and stuck into a double paper in rows of sixteen, eighteen, twenty and twenty five; and always five hundred are stuck in one paper, which is folded at both ends to meet in the middle.

Two of these papers are tied in a bladder, made of paper and fastened with a *pin*, and six of these make a *bundle*, which is tied up with a pack-thread, with the mark of the maker printed on it.

There are divers sorts of pins, *viz.* a *farthing pin*, a *four and twenty ounce*, a *twenty ounce*; and of *flat-heads*, *hundreds*, *half hundreds*, *cawkins*, *middle* and *small pins*, of each three sorts,

194 A COLLECTION for Improvement

The first tell, *cawkins* are sold by packets; from 3 s. to 5 s. each; and the rest from 6 d. to 14 d. the thousand.

Some top-workmen will make 24000 in a day, and have about five farthings a 1000; for sticking so many about 10 d. for straightening and pointing 1 s. and for drawing 3 s.

Thus to make a pin of *brass-wire*, and what belongs to it before 'tis fold, there must be the *copper-oar-finder*, the *digger*, the *smelter*, the *refiner*, the *brass-maker*, the *wire-drawer*, the *polisher*, the *sizer*, the *pointer*, the *head-maker*, the *header*, the *whitener*, the *flicker*, the *tyer-up*; besides those that make tools for, and attend all these.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, July 23. 1697. NUM. CCLX.

A patent for thimble-making. Shruff best for thimbles. How 'tis melted and cast. How cores are managed. How thimbles are cleansed. Six persons employ'd in founding thimbles. How they are turned, and the hollows made on the out-side, and the rim, and how they are wrapt up. The charge of the work, and quantity of thimbles made in a year. The weight of thimbles. The work is now at Marlow, which grinds also seeds for oil.

IN my last I gave you the history of *pin-making*: Now for *thimbles*, which were all brought

of HUSBANDRY and TRADE. 195

brought from *Holland*, till lately my good friend Mr. *John Lofting*, a merchant in *Bow church-yard*, *London*, a *Dutchman*, set up the trade at *Islington*, next door to *Young's Wells*, and got a patent for it, *Anno 1695*.

There he made them as follows, with *brass*:

Which must be of fine *metal*; for the candlesticks and ordinary metal is brittle; therefore none will do but such as will bear the hammer: Therefore battery or kettle; but the new being 8*l*. the hundred, they cannot afford it: Therefore they take *Sbruff* worth about 4*l*. the hundred, which *Sbruff* is old hammer'd brass.

This they melt and cast in a sort of sand, gotten only at *Highgate*, with which and *red-okre* are made *mould* and *cores*, and in them they usually cast *six gross* at a cast, and about six or seven of these casts in a day. They are cast in double rows, and when cold taken out and cut off with greasy shears.

Then *boys* take out the *cores* from the inside with a pointed piece of iron, which *cores* were made by them, every *core* having a nail with a broad head in it, which head keeps it from the *mould*, and makes the hollow to cast it in.

This done, they are put into a barrel as they do shot, and turn'd round with a horse, till they rub the sand one from another.

Thus far the foundery, in which are employ'd six persons: first, the founder and two men make the *moulds* ready. Secondly, two boys make *core*, for each thimble one. Thirdly, one that *blows* the bellows. From hence they are carried to the mill to be turned.

First, the inside, which works with an instrument to the bottom, while 'tis held last, and flies back when let loose. Secondly, the outside, which

196 *A COLLECTION for Improvement*

with a coarser engine call'd a rough turning is made pretty smooth at one stroke; and afterwards with a finer engine both the side and bottom are at one stroke made very smooth.

Then some *saw-dust* or *filings of horn-combs* are put half way into each *thimble*, and upon it an *iron punch*, and then with one *blow* against a studded steed the hollow of the bottom is made.

After this with an engine the sides have the *hollow* made, and in this engine is their chief secret, and they can work off with it thirty or forty gross in a day.

This done, they are again polished on the inside.

Then the *rim* with a single or double rib are turn'd at one stroke, and all these turnings are perform'd with five men and three boys.

After this they are again turn'd in the barrel with *saw-dust* or *bran* to scour them very bright, and so they are compleat *thimbles*.

Thus finish'd they are sorted, and put six together one in another; and six of these sixes are wrapt up in a blue paper, and four of these papers making a gross are wrapt up in another blue or brown paper, and tyed with a packthread, which makes them almost a square, and are sold by the first maker at four or five shillings the gross.

The charge of this work *per annum* is much about 700 *l.* and there has been made one week with another about 140 gross, which makes 7280 gross, or 1048320 thimbles, which at 4s. the gross, amounts to 1456 *l.* Out of this a great deal goes for the *shruff* 'tis made on, and a gross of thimbles weigh about 24 or 28 ounces.

He has lately remov'd his horse-mill at *Islington*; to make it a water-mill at *Marlow on the Thames*

of HUSBANDRY and TRADE. 197

Thames in *Buckinghamshire*, where with the same mill he can make twice as many *Thimbles*; he also grinds all sorts of seeds for oil at the same time.

Yours

JOHN HOUGHTON, F. R. S.

FRIDAY, November 30. 1697. NUM. CCLXI.

Divers coppers in *Gresham-college*. *The separation of copper from its oar. How silver is got from copper. How copper is shaped into vessels or plates. Sometimes sixty pound of copper is gotten from a hundred pound of oar. A water that turns iron into copper, or somewhat like it. Pins consume most copper.*

I N my two last I gave you the history of making pins and thimbles.

Now take an account of the coppers in *Gresham-college*.

There is pure *capillary copper* from the mine at *Herngrunt*; 'tis very ponderous, the *Styria* or capillary parts but short, of a reddish golden colour, growing together like those of the little stone moss.

Pure *granulated copper* from the mine, reddish, mixed with a sad purple and some green. This is called *æris flos verus*.

An iron chain and heart covered at least with a crust of pure *granulated copper*, by laying in one
of

198 *A COLLECTION for improvement*

of the two springs in the *copper mine*, called the *Ziment* in *Hungary*.

Pure *native copper*, both *capillary* and *granulated* in one piece.

Bullated copper from the *mine*. Pure of the colour of the best concocted.

Pure *massy copper* from the *mine*.

Yellow copper oar from the *mine* at *Herngrunt*, of a reddish yellow, mixed with some sparks like *gold*.

Black copper oar holding *silver*.

Another piece, with some efflorescence of *white vitriol* upon it; perceived especially by taste.

A third piece with natural *Verdigriese*.

Black copper oar immersed in a blackish stone.

A great many medicines are made from *copper*.

Dr. *Edward Brown*, F. R. S. in his travels, pag. 105, &c. tells us, that at *Newsol* are the greatest *copper works* in *Hungary*, the body of the *copper* being strongly united to its *oar*, the separation whereof is very difficult; for the *oar* is burned and melted fourteen times: And first 'tis melted with a stone they call *flus-stem*, and its own dross, with *kis*, or a sort of *pyrites*; then carried to the *roast-bearth*, and there laid on great heaps of *Billets*, and those set on fire; by which means 'tis burnt into a substance called *roast*; and this is repeated seven or eight times, afterwards 'tis melted in the melting furnace, and at two furnaces more at *Mismills*, and twice at the hammer.

At *Mismills* they get *silver*, by adding *lead* to the *copper* when melted, and when cold, they give a strong fire again as it lyeth on cross-barrs until both melt and fall through. When the *copper* has past its last melting, and is fit for use, they cut it in pieces with great hammers, which
are

of HUSBANDRY and TRADE. 199

are sharp; to move which there is a mill; and to shape it into vessels or plates they have other hammers, flat or round, as they intend, to frame the copper.

At *Herngrunt* the veins of the mine are very large, and the oar rich; for in 100 l. of oar they sometimes find sixty.

There are two springs of a *vitriolate water*, which turn *iron* into *copper*, which is more ductil, malleable and easily melted, and so near a transmutation, that it confounds Dr. *Brown*.

'Tis thought the greatest consumer of copper is *pins*; because they seldom return to the melting pot; and thus much for *copper*.

Yours, &c.

JOHN HOUGHTON, F. R.S.

FRIDAY, August 6. 1697. NUM. CCLXII.

Lead. *Its description.* The sorts in Gresham-college. *Its weight in air and water.* 'Tis heaviest unmelted. *The weight of lead comparatively with other things.*

Copper being ended, now for a history of *lead*; which Bishop *Wilkins* says is a natural *mineral*, of a hard consistence, *close*, *ductil* and *fusil*; of the most base and common sort, more soft than other metals; of a darkish colour, and not sonorous. There are of this great variety at Gresham-college, as *chrystalline lead* from the *mine*; not clear, but consisting for the most part of *hexagonal* (six-cornered) points. Oar

200 *A COLLECTION for Improvement*

Oar rich in *silver*, and growing together with iron-*oar*.

Oar probably holding *silver*. It lies in a whitish spar, not so flaky as is usual, and will cut *glass*.

Oarholding silver, with a large chrystalline *spar*, consisting chiefly of hexagonal points, and of the colour of a *calcedony*.

Sparks of oar in the *caulk*. One of the sparks is branched almost like a small leaf. The *stone* or *caulk* is a *congeries* (cluster) of white *chrystals* of *spar* laid cross every way. They will cut *glass*.

A large piece of *oar*, flaky and lying in spots in a white perspicuous, flaked and soft spar.

Some other pieces of *oar*, *English*.

Lead-oar, from *Freungen*, called *Weisserflies*.

It consisteth of a soft and friable *spar*, of a pale colour, near that of the *diaphanous* natural *sulphur*; together with a reddish substance intermixt.

Oar from the same place, called *Schlich*. 'Tis a fine grey sand, like that used for writings, with some few black grains; which is supposed the true *oar*.

See the account of the *Mendip lead mines* in the *Phil. Transactions* N. 28. and 39.

Lead (besides the uses commonly known) is also employed for the refining of gold and silver by the *cupel*. Hereof is made common *ceruse* with *vinegar*. The way perspicuously set down by *Theophrastus lib. de lap.* Of *ceruse*, *red-lead*. Of *plumbum ustum*, the best yellow *okre*. Of two parts *lead*, and one part *tin* is made *solder* for lead. Hereof are made the *oil*, *tincture*, *salt*, and other chymical preparations, which may be used, tho' with great care. Thus far *Dr. Grew*.

I am informed that *lead*, that weighs in air thirty pound, weighs in water but twenty seven pound,

of HUSBANDRY and TRADE. 201

pound, and that a piece of unmelted *lead* would swim in melted *lead*.

If *lead* in a lump weighs forty two pound, then in the same bulk *gold* weighs about sixty eight pound, *quick-silver* forty seven, *silver* thirty seven, *copper* thirty three, *tin-glass* twenty eight, *forged iron* twenty eight, *tin* twenty seven, *cast iron* twenty seven, *marble* ten, *paving-stone* nine, *free-stone* nine, *rain-water* three, *lamp-oil* three, *sallad-oil* three, *fine gun-powder* two with fractions.

Yours, &c.

JOHN HOUGHTON, F. R. S

FRIDAY, August 13. 1697. NUM. CCLXIII.

Stafford-shire lead. *Difference of oars.*
How lead is separated from the stone.
More differences. Less lead where more coal. Lead used for many things. It may be purged, calcined. From lead is made salt, sugar, &c. Lead turns to glass, and it dissolves sand. Bullet and shot made of lead. Difference in weight between large and small shot. Bullets hollow and lighter than shot. To make shot fly close.

WITH lead several countries in England abound; especially the north and west, tho' in some countries we hear of none, and not much in Stafford-shire, where Dr. Rob. Plot says, 'tis dug in a yellowish stone, with cawke and spar; and the workmen distinguish it into round, small, and

and *smithum oars*; the two last whereof are beaten to pieces with an instrument called a *knocking bucket*, and the oar separated from the *stone*, with another called a *limp*; and then wash'd in a *sieve* made with iron wire, yet farther to clear it from terrestrieties; which done, 'tis sold to the *potters* at *Burslem* for six or seven pound the tun, who have occasion for most that is found here for glazing their pots. At *Eaton-hill* some lies so near the day that 'twas first found by the plough. This also is distinguish'd into three sorts, *viz.* the best *bing*; the middle sort *powse*; and the *lead-dust, smithum*. There was a *lead oar* dug at *Ribden*, but none were ever considerable; and 'tis observ'd, that where there is much coal there is less lead, altho' at *Mendip* two or three hundred weight of good *lead oar* is found growing to a vein of coal.

Lead, by reason of its *plenty* in this our country, as also its *cheapness, fluidity, ductility*, and *durability*, is put to abundance of uses, relating to *building, water-works*, and what not; the particularizing whereof would be over-tedious.

Lead may be purged by melting, and adding white melted wax or grease to make it flame, and then putting it into hot water.

It may be calcin'd or burnt, so as to be powder'd by help of fire or sharp liquors.

From it is made a *salt* or *sugar*, and a great many other medicines, as may be seen in dispensatories.

I have seen *lead* melted and stirr'd in an iron mortar, till it has turn'd to perfect glass; and if it be done in a stone crucible, 'twill eat its way presently; or if you mix some crucible with it,

of HUSBANDRY and TRADE. 203

that is made of sand, 'twill quickly dissolve and incorporate with it.

A great many *bullets* for musket and pistol are made with it, by being cast into moulds.

Shot for the destruction of fowl is made of it, after another manner, which expect in my next.

About six years since, at a shot shop in *Thames-street*, I weighed a wine half-pint pot full, struck with the back of my knife of small *lark-shot*, *Num.* 4. which weighed (wanting just turning scale) three pounds fifteen ounces.

The same measure of *Bristol goose-shot* weighed but three pounds thirteen ounces and three quarters.

Both of these the shot-man said were hollow within, as were all shot; but I cut both thro' and could see none.

I cut also a carbine bullet in the middle, which had a great hollowness, and the shot-man said, that a barrel holding a hundred weight of shot will not hold so much bullet by five or six pound.

I am inform'd, that if the quantity of a pea of *opium* be charged among *case-shot*, 'twill fly closer together.

Yours,

JOHN HOUGHTON, F. R. S.

FRI-

FRIDAY, *August* 20. 1697. NUM. CCLXIV

How shot is made.

TO make *shot*, you must take *lead* out of the *pig*, what quantity you please; melt it down, stir and clear it with an iron ladle, gathering together the blackish parts that swim at top like scum; and when you see the colour of the clear lead to be greenish (but not sooner) strew upon it *auripigmentum* powder'd, according to the quantity of *lead*; about as much as will lie on a half crown piece will serve for 18 or 20 l. of some sorts of lead; others will require more or less. After the *auripigmentum* is put in, stir the lead well, and the *auripigment* will flame; when the flame is over, take out some of the *lead* in a ladle, having a lip or notch in the brim for convenient pouring out of the *lead*; and being well *warmed* amongst the melted *lead*, with a stick make some single drops of *lead* trickle out of the ladle into water in a glass; which, if they fall to be round, and without tails, *auripigment* enough is put in, and the temper of the *lead* is right; otherwise put in more. Then lay two bars of iron (or some more proper iron tool made on purpose) upon a pail of water, and place upon them a round plate of copper, of the size and figure of an ordinary large pewter or silver trencher, the hollow whereof is to be about three inches over, the bottom *lower* than the brims about half an inch, pierced with thirty, forty, or more small holes; the smaller the holes the smaller the *shot* will

will be; and the brim is to be thicker than the bottom, to conserve the heat the better, the bottom of the trencher being four inches distant from the water in the pail: Lay upon it some burning coals to keep the *lead* melted upon it; then with a hot ladle take *lead* from the pot where it stands melted, and pour it softly upon the burning coals over the bottom of the trencher, and it will immediately run through the holes into the water in small round drops. Thus pour on new *lead* still as fast as it runs thro' the trencher till all be done, blowing now and then the coals with hand-bellows, while the *lead* that is in the trencher cools so, as to stop from running.

Whilst one pours on the *lead*, another must with another ladle, thrust four or five inches under water in the pail, catch from time to time some of the *shot* as it drops to see the size of it, and whether there be any fault in it. The greater care is to keep the *lead* upon the trencher, in the right degree of heat: If it be too cool, it will not run thro' the trencher tho' it stand melted upon it; and this is to be kept by *blowing* the coals a little, or pouring on new *lead* that is hotter; but the cooler the *lead*, the larger the *shot*; and the hotter, the smaller.

When it is too hot, the drop will crack and fly; then you must stop pouring on new *lead*, and let it cool; and so long as you observe the right temper of heat, the *lead* will constantly drop into very round *shot*, without so much as one with a tail in many pounds.

When all is done, take the *shot* out of the pail of water, and put them in a frying-pan over the fire, and dry them, which must be done warily, still shaking them that they melt not;

and when they are dry, you may separate the small from the great in great sieves, made of *copper* or *latten*, let into one another into as many sieves as you please. But if you would have your shot larger than your trencher makes them, you may do it with a stick, making it trickle out of the ladle, as hath been said. If the trencher be but touched very little, when the *lead* stops from going thro' it, and be not too cool, it will drop again; but it is better not to touch it at all. At the melting of the *lead*, take care there be no kind of oil, grease, or the like, upon the pots, ladle, or trencher.

The chief cause of this globular figure of the *shot* seems to be the *auripigmentum*; for as soon as it is put amongst the melted *lead*, it loses its shining *brightness*, contracting instantly a greyish film or skin upon it, when you stir it to make it clear with the ladle; so that when the air comes at the falling drops of the melted *lead*, that skin constricts 'em every where equally; but upon what account, and whether this be the true cause, is left to farther disquisition.

Yours, &c.

JOHN HOUGHTON, F.R.S.

FRI.

FRIDAY, *August* 27. 1697. NUM. CCLXV.

How to make ceruss. The lead is cast into plates, roll'd, and put into pots with Vinegar. Laid in a horse-dung, there digested, flaked, beaten, ground, folded and potted again, dryed and used. Accidents to the work and workmen.

IN my last I gave you the history of making shot; now for the making of *ceruss*.

First, piggs of clean and soft *lead* are cast into thin plates a yard long, six inches broad; to the thickness of the back of a knife: These are roll'd with some art round; but so as the *superficies* no where meet to touch; for where they do, no *ceruss* grows.

So roll'd, they are put each in a pot just capable to hold one, upheld by a little *bar* from the bottom, that it come not to touch the *vinegar*, which is put into each pot to effect the conversion.

Next a square bed is made of new *horse-dung*, so big as may hold twenty pots a-breast, to make up the number of four hundred in one bed; then each pot is covered with a plate of *lead*; and finally all with boards as close as conveniently can be: This repeated four times, makes one heap so called; and contained 1600 pots.

After three weeks digestion, the pots are taken up, the plates unroll'd, laid upon a board, and beaten with battledores till all the flakes come off; which, if well taken, come off, and prove
P 2 thick,

thick, hard, and weighty; if otherwise, fuzzy and light; or none sometimes, or black, and sometimes burnt, if the *dung* proves not well order'd.

From the *beating-table* the flakes are carried to the mill; and with water are ground between *mill-stones*.

Then this matter is folded into smaller pots and exposed to drying by the sun, till it be hard, and so is used.

The accidents of the work are,

That two pots alike ordered and set by one another, without a possible distinction of advantage, shall yield the one thick and good flakes, the other few and small; and that happeneth in greater quantities, and over whole beds sometimes.

Sometimes the pots are taken all up dry, and so prove best, sometimes some wet, some dry; and whether this ariseth from the exhalations coming from below, or the moisture that is squeez'd by the weight of the pots that stand above, we cannot discern. This we observe, that the plates that cover the pots yield better and thicker *flakes* than the rolls within; and the out-sides next to the planks, bigger and better than the insides next to the rolls, and to the spirits that first arise out of the vinegar. We question whether the strongest body'd vinegar, or the quickest and the sharpest, does the best effect.

The accidents to the workmen are,

Immediate pain in the stomach, with succeeding contorsions in the guts over the whole belly, and a constipation that yields not to *purging physick*, hardly to often repeated *clysters*; but to *laxatives*, *oil of olives*, or strong *new-wort*; and brings them to sharp *fevers*, and great *shortness of breath*, and that without any apparent hurt to the parts wherethe noxious humour is to pass. This

This we find most to be caused by the *mineral exhalations* of the *lead* in the casting of the thin plates and the dust of them. Also from the *steam* coming out of the heaps in the taking up of the pots, and the dust of the *flakes* in beating them from the plates.

The next is *dizziness* in the head, with continual great *pain* in the brows, *blindness* in the eyes, and a *stupidity* in the brain and the *nervous parts* of the body, *loss* of appetite, much *queasiness* in the stomach, and often *vomitings*, that bring up only *flegm*, sometimes mixt with choler to the extream weakening of the body.

And this in them that have the charge in grinding, and over the drying place.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, Septemb. 3. 1697. NUM. CCLXVI.

*How lead purifies gold and silver, and li-
tharge is made. How lead is calcin'd,
and minium made also plumbum ustum.
Why these are mix'd with ointments and
plaisters. Calcin'd lead encreases in weight.
A Reason. It may be reduc'd to lead a-
gain. Mill'd lead.*

IN my last I gave you an account of making
ceruss; and Dr. *Nicholas Lemery*, in his course
of *Chymistry*, tells us, that it purifies gold and
P 3 *silver,*

210 A COLLECTION for Improvement

silver, as the *white* of an egg clarifies a *syrup*, viz. the *heterogeneous* parts in the *gold* or *silver* stick to the *lead*, and by the fire are driven to the sides of the *copel* like unto a scum; and this is called *litharge* of *gold* or *silver*, according to the degree of *calcination*.

The *calcination* of *lead* is by melting it in an earthen unglaz'd pan, and stirring it over the fire with a *spatula*, till 'tis reduc'd to a powder. If you encrease the fire, and still calcine it for an hour or two, 'twill be more open, and fit to be penetrated by acids.

Calcine this powder in a reverberatory fire for three or four hours, it will be of a red colour, and is called *minium* or *red-lead*.

Take two parts of *lead* melted in a pot or crucible, and add to it one part of *sulphur*: When the *sulphur* is burnt out, the matter will be in a black powder, which is *plumbum ustum*, or burnt *lead*.

All these preparations are drying; they unite with *oil* or *fat* in boiling, and give them a solid consistence; therefore they are mixt with *ointments* and *plaisters*.

In the *calcination* of *lead*, as well as several other things, 'tis observ'd, that altho' the sulphureous or volatile parts of *lead* do fly away in the calcination, which should make it weigh less; nevertheless after a long *calcining* 'tis found that it encreases in weight.

My author refers this effect to the disposition of the pores of *lead* in such a manner, that part of the fire insinuating into them, does there remain embodied, and can't get forth again, whence the weight comes to be encreased.

He also says, that if you would revive this *calc* of *lead* by way of *fusion*, its parts do squeeze and
express

express the *igneous* particles that were enclosed, and the *lead* does thereby weigh less than it did, when reduced into a *calx*: for by this means the *sulphureous* parts are separated and lost.

These facts are affirmed; but surely if these *sulphureous* particles get in, they must encrease the bulk, and make the mass specifically lighter; for *lead* is a body of very heavy particles; and *sulphurs* are light, and how that which is sending forth by force of *fire* should encrease, is strange, and that by carrying it higher to a fusion should make it lighter is most strange.

Sure it must only be heavier when *cold*; the pores being made more capable to receive aerial particles, as dry linen will in moist weather; and when it's reduc'd to *lead*, these particles are again evaporated. But I do not pretend to determine.

Dispensatories give several other uses of *lead*; and there I'll refer you.

Lead is mightily improv'd of late by a new invention of milling, which renders the sheet exactly equal in all its parts, and more smooth and solid than cast-lead can be; whereby it becomes more beautiful and serviceable for all purposes, and for covering houses, churches, and all things where the lead is used, than the other, it being to be had of any thickness desired, and the sheets of three foot and half broad, above twice as long as the plumber can cast, if required. Also the thinner sort of three pound to a foot square, with the nails made of a mixt metal agreeable thereto, is an excellent sheathing for ships, it being a certain security against the worm; and much better for sailing than wood-sheathing can be; and (with respect to its duration, and the charge of graving saved) above *cent. per cent.* cheaper, as I am informed, some eminent merchant-owners

212 *A COLLECTION for Improvement*

upon the *Exchange* having lately sheath'd several ships therewith bound on voyages to *Guinea* and the *West Indies*.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, *Septemb.* 10. 1697. NUM. CCLXVII.

Iron, what it is. How much of all sorts was imported 1694. A catalogue. Remarks on trade.

MY last was a history of *lead*. Now for *iron*; which Bishop *Wilkins* says is a *mineral* of a hard consistence, *close, ductil, fusil*: 'tis reckon'd among the *perfect natural metals*: such as of it self grows in the earth, without any kind of mixture, or other help by the art of men; and 'tis of a more base and common sort, being the common matter for *weapons* and *tools*.

In the year 1695, there were imported to *London* of *iron* from *Denmark* 146 tuns and 16 hundred; from *Sweden* 9369 tuns and 14 hundred; from *Germany* 53 tuns; from *Holland* 6 tuns and 3 hundred; from *Spain* 23 tuns and 5 hundred; in all, 9598 tuns and 18 hundred. Of *old iron* from *Holland* 201 tuns and 5 hundred; from *Flanders* 15 tun; in all, 216 tun and 5 hundred. There came also from *Holland* 1516 *iron backs* (I presume) for chimneys; 1573 *barnefs plates*, 201 *stoves*, 106 *doubles*, two *saws*. From *Denmark* 108, and from *Holland* 1021 *iron pots*; in all,

of HUSBANDRY and TRADE. 213

all, 1129, from *Germany* 20, and from *Holland* two; in all, 22 *iron chests*. From *Germany* 96 large *snuff-boxes*. From some part of *England* formerly imported 92, and from *Holland* 496 hundred of *iron wire*; in all, 588 hundred. Also there came of *latten-wire* (which I take to be wire used in tin-works) from *Dantzick* 7, *England* 26, *Sweden* 3050, *Germany* 978, *Holland* 30, and *Flanders* 16 hundred; in all, 4107 hundred.

From *Sweden* came of *black-latten* 24 hundred, from *Germany* 31 hundred; in all, 55 hundred.

Of *steel*, which is made of *iron*, came from *Dantzick* 26, *Denmark* 30, *Sweden* 296, *Holland* 1214. *Spain* 32, *Streights* 4, *Germany* 77 hundred; in all, 1679 hundred.

Moreover came from *Holland wrought steel* 89 hundred and four pound one cask, one barrel, 12 dozen cases, two bundles of *files*, 401 hundred and 10079 pound, of *steel-wire* 75000 and certain needles; and of *metal* prepared 105 hundred, and of *metal* prepared to make *iron-wire* 6 hundred.

So that here has been imported *iron*, *old iron*, *iron-backs*, *harness-plates*, *stoves*, *doubles*, *saws*, *iron pots*, *iron chests*, *snuff-boxes*, *iron-wire*, *latten-wire*, *black latten*, *steel*, *wrought-steel*, *cases*, *files*, *steel-wire*, *needles*, *metal* prepared, and *metal* prepared to make *iron-wire*.

And altho' *Holland* be a country that (for ought I can learn) has neither *mine* nor *fewel* to work *mineral* with, yet 'tis very few of this catalogue that comes not from thence, especially of those that are most manufactur'd, and of greatest value. Oh! the advantage of encouraging of trade. It keeps in a country always great stores of every thing, not only for employing the manufactors always, by which the country encreases much,
but

but also for supplying all other countries in the world with what goods soever they shall stand in need of; and altho' they sell very cheap to those that are not streighten'd, yet they always make those pay for it that are.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, *Septemb*. 17. 1697. NUM. CCLXVIII.

An account of divers iron oars.

OF *irons* there are many sorts at *Gresham-College*: There is *brush-iron native*, or from the *mine*. It consisteth of strait round long *Styriae*, about the thickness of a small *knitting-pin*, bolt upright, like the bristles of a stiff *brush*, or the teeth of a *wool comb*. They grow on a double bed, the uppermost of an *iron colour*, the undermost of a dark yellowish red.

Brush-oar; from *Doward* in *Herefordshire*. A rich sort, consisting of strait and almost parallel *styriae*, most of them as thick as a strong *knitting-pin*; incrustated with very small grains of *spar*, of the colour and bigness of the corns of *bay-salt*, but very soft.

Mixed *brush-oar* from *Clower-Wall* in the forest of *Dean*, consisting of several *piles* of round and parallel *styriae*, and *layers* of unfigur'd *oar*, a *pile* of the one, and a *layer* of the other cross-ways; seven or eight in this piece, within the extent of four or five inches.

Another

of HUSBANDRY and TRADE. 215

Another of kin to it. 'Tis rich, with only some few *styriae*.

Another, in which the *styriae* or figur'd pieces are flat and irregularly cluster'd.

A rich iron oar from *Sen* or *Send* in *Wiltshire*, about nine miles from *Bath*. 'Twill easily melt contrary to that in the *Forest of Dean*. Near it is a strong *chalybate spring*.

Mixed iron oar from *Doward* in *Herefordshire*, consisting of four or five substances. The best part brown and red, or brick-colour'd, where-with is mixed a white and soft *spar*, with a blackish, shining, and crumbling body, knobb'd on the top, after the manner of the *turcois*.

Ordinary iron oar, almost of a brick-colour, or of *colcothar* of *vitriol*.

Iron balls as big as *musquet-bullets*, made by the rolling of iron-sand off the banks, among the iron mines near *Senneck*, especially after rain.

Two bones (part of a man's foot) turn'd into iron-stone.

A piece of *drop-stone* turn'd to iron.

An iron oar, in some parts of a brown cinnabar colour, and mixed with *slate*. The loadstone takes up little corns of it no bigger than sand.

An odd iron oar, scarce fixable. In a white *spar*, almost like a *calcedony*, hard enough to cut glass.

A sort of black *caule*, holding iron, yet so little, that a loadstone will take up a piece no bigger than a pin's head. It hath a black, shining, and very cross grain, with white *spar* interspers'd, which cuts glass.

Another iron *spar*, consisting of little white and umber-coloured columns, laid together cross-ways.

Yours, &c.

JOHN HOUGHTON, F. R. S.
FRI-

 FRIDAY, Septemb. 24. 1697. NUM. CCLXIX.

*Variety of irons. Due tempers for iron.
How to harden iron. Divers varieties
in iron-works.*

BESIDE what I gave you last Week, there are at *Gresham-college*, an *iron body* that rubs away in glossy dust; with part of its wall (a brown spar) in which it lay enclosed.

A piece of the *old cinder*, which now they use as a flux for the *iron oar*; somewhat bubbly. From the *iron mines in Monmouth*.

Another from the forest of *Dean*. 'Tis run into *styriæ*, somewhat like those of ice, brittle, ponderous, opacous, glossy, and of the colour of the coarsest sort of *crocus metallorum*.

A *vitriified cinder*, like a piece of coarse green glass.

An *iron stone*, with a *spar* on one side, consisting of pellucid squares; on the other of white flakes set cross-ways, almost at right angles one against another.

A piece of *rusma* or *crude zernick*, almost of the colour of *crocus metallorum*, or some sorts of the *hematites*.

In Numb. 137. of the *Philos. Transf.* is a very good account of the *iron mines* and *iron works* in the forest of *Dean*.

Some ways of giving a due temper to *iron* are set down by *Ambrosinus*, *Aldrov. Mus. Met.* For one temper is required for drawing it into *wire*, another for a *file*, another for a *chisel*, another for

of HUSBANDRY and TRADE. 217

for a sword, another for the edge of a sword, and the like.

For the hardening of iron for files this is commended.

Take *horse-hoofs*, or *rams-horns*, and hang them over the fire till they drop like *glue*. Take also pieces of *leather* and burn them black, powder them both, and put to them stale *urine* and *bay-salt*. Let them stand together, the longer the better. At three or seven years end it will be excellent. Case the *iron* with this mixture, and give it a strong heat, sufficient to *fuse* the mixture for three hours; and then cool it. The surface of this *iron* will be as hard as the hardest *steel*, and will make excellent *files*. But the hardening reaches not to the heart of the iron.

Of *rusma* (a brown and light iron substance) with half as much *quick-lime* steeped together in water, the *Turkish* women make their *psilothron* to take off their hair wheresoever they please.

There are many medicinal preparations of *iron* and *steel*. Thus far Dr. *Grew*.

There are *iron* plates made at *Lyons* in *France*, which *silver-wire-drawers* draw their *wire* thro'; and none in the world (as I am inform'd) can make so good, for it is soft and gives gentle way to the *wire*, when others by its stubbornness will have an edge and cut it; and when the holes are too big, they may be knock'd up to what degree desired.

Yorkshire yields iron for the needles of *stocking-frames* and no other *iron* for that use like it.

Near *Aldgate* in *Crouched-friers* are the *non-such* engines for flatting of *wire*.

'Tis a rarity to make good springs for watches; and I am told there are not above two in *London* that

218 *A COLLECTION for Improvement*

that are excellent for making *steels* for *butchers* to
whet their knives on.

Yours,

JOHN HOUGHTON, F. R. S.

FRIDAY, October 1. 1697. NUM. CCLXX.

*The earths over iron-stone. The signs of
good oar. The names of iron oars. The
different sorts of oars. A sweet liquor in
iron-stone, what 'tis thought to be.*

DR. Rob. Plot in his history of *Staffordshire*,
Chap. 4. Par. 10, &c. tells us, that in dig-
ging for *iron-stone* they meet first with a small
*bas*s; then a strong *bas*s; then a stone, from his
colour call'd a *blue-cap*; and after that the *iron-
stone* of a darkish blue colour, which ordinarily
lies there not above two foot in thickness.

On *Mear-Heath* they observe in digging for
iron-stone, that if they meet with rocks, sand,
gravel and clay, that the head of the mine is
quickly eaten out; especially the last, which so
keeps down the head, that it comes to nothing
presently, all which they count bad, the works
being thinner and more chargeable to dig: But
if they meet with *mine-earth*, which is *white*, then
they promise themselves good mines both of *iron-
stone* and *coal*, which, as at most other places,
lie here together; the stone above the coal, be-
tween four fingers and half a foot thick, having
*bas*s above and below it; in which they meet an
iron

of HUSBANDRY and TRADE. 219

iron oar call'd *ball-stones* distinct from the vein; and then indeed 'tis thicker: Where *iron-stone* and *coal* lie together, they call it the *deep mine*, which is not the best, the *chalky-mine* and the little mine being preferr'd before it; yet they are all work'd by Mr. *Foley*.

About *Dudley*, where the *iron-stone* lies under the ten yards thickness of coal, and above the heathen-coal of a considerable thickness: It is divided into divers measures of different denominations; as the *black-row-grains*, the *dun-row-grains*, the *white-row-grains*; all so call'd from earths of those colours in which they lie, the *rider-stone*, the *cloud-stone*, the *bottom-stone*, the *cannoc* or *cannot-stone*. At *Walsal* and *Rushal* they divide their *iron-oar* into *black-bothum*, *grey-bothum*, *chatterpye*, being of the colour of a *mag-pye*, *grey-measure*, *musb*, and *white-measure*: The two last the principal sorts, but *musb* the best of all, some of it being a small comby-stone, other some round and hollow, and many times fill'd with a brisk sweet liquor, which the workmen drink greedily; so very rich an oar that it may be made into *iron* in a common forge.

Also at many other places, as *Cheeslinhay*, *Red-street*, *Apedale*, *Wednesbury*, *Darlaston*, &c. they dig *iron-stone*, the several measures whereof have also obtain'd different names, tho' gotten but at little distance from one another; but these above are a *specimen*.

This sweet liquor the Doctor thinks to be the *gur* of the *adeptists*, i. e. the matter of metals before it be coagulated into a metallic form; for some of it being dried pretty hard, and burnt in a *crucible*, it quickly maturated into iron, and applied to the *magnet*. The *gur* of *lead* is affirmed to be of the same colour and consistence.

Next

Next week I shall give some farther account of these oars and their uses; and am,

Yours

JOHN HOUGHTON, F. R. S.

FRIDAY, October 8. 1697. NUM. CCLXXI.

Different sorts of iron, with their description and use. How they run iron.

OF the oars mentioned in my last they make several sorts of *iron*, differing in goodness according to the richness or poverty of the oars, and having names somewhat agreeable to the qualities of each metal. The first and meanest they call *yellow share*, a sort that runs all to dirt, and is good for nothing; and such is the iron made of the *cannock* or *cannot-stone*, the lowest measure of *iron-oar* about *Dudley*, which is so sulphureous and terrestrial, that it is not fit to make *iron*. This sort some call *red-share*, because a *plough-share* made of it will crack in the *red-heat*. The second is stil'd *cold-share*; which, tho' it will not break when red-hot, yet in *hot-heat* or *cold*, the biggest bar of it may be broken with a small blow upon an anvil, if it be perfect *cold-share iron*; the oar for this iron they have at *Cheeslinhay*, *Redstreet*, and *Apedale*. The worst and leanest is from *Cheeslinhay*; the next from *Redstreet*, being a red stone; and the best of the three from *Apedale*, being of a bluish colour, and call'd *Boylom*; yet these three are commonly mixed together,

ther, and sometimes with other *stones* to make 'em better or worse. The only use known for this sort of *iron* is to make small two-penny nails, and sheathing-nails for ships, having broad heads and short shanks, to keep the timber from being eaten by grubs.

The third sort made in *Staffordshire* is call'd *blend metal*, of which is made nails from three to ten shillings, and all sorts of heavy ware, such as hammers, &c. and in some countries *horseshoes*; for which the oar comes from *Wednesbury* and *Darlaston*. The fourth and best sort they call *tough-iron*, of which the best wares are made, there being nothing so good but may be made of this, for which they have their oar chiefly at *Rushall*, and some from *Walsall*; but not so good. Of these irons they make their best wares mediately or immediately, the best iron of all being made out of the filings and parings of the *lock-smiths*; which they make up into *balls* with water, and dry them by the fire till hard; then they melt it in the fire by blast, licking it up with a rod of *iron*, as they do glass; and then beat it into a bar which they use chiefly for *keys* and other fine works.

Before the oar is fit for the furnace, 'tis burnt or calcin'd upon the open ground, with small charcoal, wood, or sea-coal, to make it break into small pieces, which will be done in three days; and this they call *annealing*, or fitting it for the furnace. In the mean while they heat their furnace for a week's time with charcoal without blowing it, which they call *seasoning*; and then they throw the oar in with the charcoal, viz. a basket of one on a basket of the other, and so on; and by two vast pair of bellows placed behind the furnace, and compressed alternately

by a large wheel turn'd by water, the fire is made so intense, that after three days time, the metal will begin to run, still after encreasing, till in fourteen nights time they can run a *sow* and *piggs* once in twelve hours, which is done in a bed of *sand* before the mouth of the furnace; and the manner expect next *Friday* from

Yours

JOHN HOUGHTON, F. R. S.

FRIDAY, October 15. 1697. NUM. CCLXXII.

How they cast sows and piggs of iron. How to make the furnace, and avoid the ill conveniencies.

LAST week I promised the manner of *running sows* and *piggs* of *iron*, which they do in a bed of *sand* before the mouth of the *furnace*, wherein they make one larger furrow than the rest; next the *time* (where the metal comes forth) which is for the *sow*, from whence they draw two or three and twenty others (like the *labels* of a *file* in heraldry) for the *piggs*, all which they make greater or lesser, according to the quantity of their metal: into these, when their *receivers* are full, they let it forth, which is made so very fluid by the violence of the fire, that it not only runs to the utmost distance of the furrows, but stands boiling in them for a considerable time. Before it is cold, that is, when it begins to blacken at the top, and the *red* to go off, they break the *sows*

sows and *piggs* off from one another, and the *sow* into the same length with the *piggs*; tho' in the running it is longer and bigger much, which is now done with ease, whereas if let alone till quite cold, they will either not break at all, or not without difficulty.

In melting of *iron oar* some have great regard to the make of the *furnace*, and placing the *bellows*, and for the *hearth* of the *furnace*, into which the *oar* and *coal* fall. This furnace is ordinarily built square, the sides descending obliquely, and drawing near one another toward the bottom like the *hopper* of a mill, where these oblique walls terminate, which is termed the *boshes*. There are join'd four other stones, which are commonly set perpendicular, and reach to the bottom stone, making the *perpendicular square* that receives the metal; which four walls have the following names; that next the bellows, the *tuarn* or *tuiron-wall*; that against it, the *wind-wall* or *spirit-plate*; that where the metal comes out, the *timp* or *fore-plate*; that over-against it, the *back-wall*; and these according as they may be pitch'd less *transhaw*, or more *borrow*, will mend, they say, or alter the mixture of the *iron*; if *transhaw* or *transfiring* from the *blast*, the *iron* will be more *cold-shear*, less fined, more indeed to the *master's* profit, but less to him that has the *manufactory* of it, and to him that useth it; whereas the *iron* made in a *borrow-work* is much more tough and serviceable. Nor is the ordering of the *bellows* of less concern, which have usually their entrance into the *furnace* between the bottom of the *hopper* or *boshes*, and the *bottom-stone*, and are placed nearer or farther off according as the *oar* and *metal* require. 'Tis also of importance in melting of *iron-oar*, that there be five or six *sows* made

224 *A COLLECTION for Improvement*

under the furnace (as it is at *Mare*) in parallel lines to the stream that turns the *wheel*, which compresses the *bellows* to drain away the moisture from the furnace: For shou'd the least drop of water come into the metal, it would blow up the furnace, and the metal wou'd fly about the workmens ears: From which *sows* they must also have a *conical pipe* about nine inches at bottom, set to convey the damp from 'em into the open air, which too otherwise wou'd annoy the workmen even to death.

Yours,

JOHN HOUGHTON, F. R. S.

FRIDAY, October 22. 1697. NUM. CCLXXIII.

How the sows and piggs of iron are prepared for bars, and drawn into such, cut and fagoted. A note of late improvements.

FROM the *furnaces*, as in my last, their *sows* and *piggs of iron* (when broken asunder, and into lengths) are to the *forges*, which are of two sorts; but commonly (as at *Cunfall*) standing together under the same roof, one whereof they call the *finery*, the other the *chafery*; they are both open *hearths*, upon which they place great heaps of coal, which are blown by bellows like to those of the furnaces, and compress'd the same way, but nothing near so large.

In

of HUSBANDRY and TRADE. 225

In these two *forges* they give the sow and piggs five several heats before they are perfectly wrought into *bars*. First, in the *finery* they are melted down as thin as lead, where the metal in an hour thickens by degrees into a lump or mass, which they call a *loop*: This they bring to the great hammer raised by the motion of a water-wheel, and first beat into a thick square, which they call a *half-bloom*.

Then secondly they put it into the *finery* again for an hour, and then bring it again to the same hammer, where they work it into a *bloom*, which is a square bar in the middle, and two square *knobs* at the ends, one much less than the other, the smaller being called the *ancony-end*; and the greater the *mocket-head*. And this is all they do at the *finery*.

Then thirdly, the *ancony-end* is brought to the *chafery*, where after it has been heated for a quarter of an hour, it is also brought to the hammer, and there beat quite out to a bar, first at the end; and after that the *mocket-head* is brought also fourthly to the *chafery*, which being thick, requires two heats, before it can be wrought under the hammer, into bars of such shapes and sizes as they think fittest for sale.

Whereof those they intend to be cut into rods are carried to the *slitting-mills*, where they first break, or cut them cold, with the force of one of the wheels, into short lengths; then they are put into a furnace to be heated red-hot to a good height, and then brought singly to the rollers, by which they are drawn even, and to a greater length: After this another work-man takes them whilst hot, and puts them through the *cutters*, which are of divers sizes, and may be put on and off according to pleasure: Then

another lays them straight also whilst hot, and when cold, binds them also into faggots, and then they are fit for sale. And thus from the Doctor I have given an account of the *iron-works* of *Staffordshire* from the oar to the *slitting-mills*, as they are now exercised in their perfection; the improvement whereof we shall find very great, if we look back upon the methods of our ancestors that made iron in *foot-blasts* or *bloomeries*, by mens treading the *bellows*, by which way they could make but one little lump or *bloom* of iron in a day, not a hundred weight, leaving as much iron in the *slag* as they got out. Whereas now they will make two or three tuns of cast iron in twenty four hours; leaving the slag so poor, that the founders cannot melt them again to profit. Not to mention again the vast advantage they have from the new invention of *slitting-mills*, for cutting their bars into rods, above what they had antiently.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, October 29. 1697. NUM. CCLXXIV.

Cast iron, *used for rolls, &c. and 'tis very brittle.* Lapis hæmatites will apply to the magnet; and therefore reckoned one of the iron-oars. It cures beasts that make bloody water with constant success. The manner of hardening iron.

AS I before shewed the *iron-works* of *Staffordshire* are exercised in their perfection; and all their principal iron undergoes all the fore-mentioned preparations; not but that for several purposes, as, for the backs of *chimneys*, *garden-rolls*, and the like, they use a sort of *cast-iron*, which they take out of the *receivers* of the *furnaces*, as soon as 'tis melted, in great ladles, and pour it into moulds of fine sand, in like manner as they cast the other softer metals. Thus the ingenious *William Chetwind* of *Rugely*, Esq; at *Madely* furnace, cast *iron-rolls* for gardens, hollow, like the mills for *sugar-canes*, of five, six, seven or eight hundred weight a-piece; the hollows whereof being fill'd with timber, and wedg'd up close, the other *iron-work* of the roll is fastened to the wood in the same place, as in other *rolls*, which are weightier and more substantial than most other *rolls*. For such purposes as these, this serves well enough; but for others it will not; for it is so brittle, that being heated, with one blow of a hammer it will break all to pieces.

To add to this, there was found in the grounds of *Mr. Wightwick* of *Wightwick*, a reddish stone,

much like *cinnabar*, very weighty, and drawing red lines, being wet with the tongue, which upon calcination was found to apply to the *magnet*, and to be nothing else but a *hæmatites*, which, for that reason is very rationally reckon'd one of the *species* of *iron-oars*. And of this kind are the red-stones found in *Tene-Brook*, which are also very weighty, and draw (being a little wet) red lines like *ruddle*, and is call'd there the *sanguine* or *blood-stone*, which they use to give in new milk, and sometimes in ale warmed, to their cattle, that make a mean or bloody water; and this with constant success: For styptical qualities, always attend *ferrugineous* bodies. In the 9th Chapter, Par. 73. the Doctor tells us how they harden *iron*, in order to its receiving a better *polish*, which antiently was performed with the *hoofs* and *horns* of *cattle*, *sand* and *salt*, whereof sea or bay-salt has been preferr'd, and which formerly they used to put into a *coffin* made of clay fitted to the iron, intended to be hardened, and so committed to the fire, but lately they have used divers other materials after a different manner; it being done at *Wolverhampton*, with burnt *hoofs* and *horns*, *fountain* and *bay-salt*, *sublimate*, *urine*, *old burnt leather*, and *tartar*, all mix'd together, and reduc'd into powder; in which rolling their *iron*, first made red-hot, it will stick to it, and is thus returned into the fire again to receive its hardening, which it does not quite through the whole body of the *iron*, but only on the outside for about the thickness of a shilling at most, which is highly sufficient to receive a *polish*.

But out of these and some few other *materials*, they have observed that two sorts of hardening arise, *viz.* *tough hardening*, and *brittle hardening*;

dening; an account whereof expect in my next, from

Yours,

JOHN HOUGHTON, F. R. S.

FRIDAY, Novemb. 5. 1697. NUM. CCLXXV.

Tough hardening, how perform'd, and brittle hardening. Steel, how made now, and how formerly.

TOUGH hardening of *iron* in *Staffordshire* they perform with *old shoes* burnt, *urine* and *wood-foot*; with which, when any *iron* is hardened, it will not *scale* in the least, and *brittle-hardening* with *old shoes*, *tupps-horns*, *bay-salt* and *argol* or *tartar*; which harden *iron* to the height, and give the brightest *polish*; tho' they render it brittle. But I was told by others, that the toughest hardening was made by the Juice of *nettles*, *man's urine* and *linseed-oil*; and the highest, by quenching hot *iron* in the juice of *mouseare*; which processes are understood by most *smiths* in the county; and the reason of them the Doctor pretends to give in his 74th paragraph, and thither I'll refer the curious.

But beside the aforesaid hardenings which are only superficial, at the tile-house at *Bromley* in the parish of *King's-Swinford*, one *John Heydon* hardens whole bars of *iron* quite through, that is, makes 'em into *steel*, which he does, not out of *English*, but *Spanish* or *Swedish* bars, there called *bullet-iron*; the manner thus.

He

He has a round *oven* built of *brick* like a baker's at the top, having a grate in the bottom near the middle, about a foot and half or two foot wide, where he lays the *coal*; on each side whereof, and at the end beyond it, he lays his iron inclosed in coffins made of *amblecot-clay* to keep it from melting; the *coffins* being proportion'd to the bars of iron, which are broken into lengths of between three and five foot long, the longest being placed at the end of the oven, and the shortest on each side; each coffin containing half a tun of iron. When the fire is put to it, it is constantly tended day and night till the operation is perform'd, which, according to the goodness or badness of the coal, is done in a longer or shorter time, sometimes in three days and three nights, other times in four, and sometimes not under a week's time, the *critical minute* in which the operation is finish'd being the great secret of the art of making *iron* into *steel*. Which, when done, they cut it into narrower bars about half an inch over, and then break it into short pieces of an inch or two inches long, call'd *gadds*, whereby the buyers may see whether it be good or bad (for there may be both in the same bar) otherwise they care not to buy it.

This is the method of steel-making at the abovesaid place; and in *Aristotle's* time 'twas perform'd by a frequent ignition, now by a long one, whereby all salt is driven out, even from the center, and the bulk is diminish'd in proportion. Whereas formerly the vitriol of *Mars* was only superficially destroyed, either by the superinduction of an *opposite salt*, or dipping it red-hot (whilst the parts are open) in some peculiar *juices*, which also superficially dissolve the *salts*, and so take them away as *common water* it self will

of HUSBANDRY and TRADE. 231

will also do, tho' perhaps not so well as some of the juices there mentioned; those being certainly the best, that are highest impregnated with alkalizate salt.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, Novemb. 12. 1697. NUM. CCLXXVI.

*Annealing of iron. Softning with fat things.
2000 nail-makers in Sedgley. Extraor-
dinary locks.*

NOTwithstanding what I said in my last about heating the *iron* for superficial hardening, the Doctor mistrusts there must be some other applications for the *central hardening* or making of steel, beside what *John Heydon* was willing to impart, it being evident, that heating of *iron* only, and letting it cool in the fire, does rather soften than harden it, as we plainly see in the annealing of *wire*, and other *irons*; which often heated, and suffered to cool in the fire as it goes out of it self (provided it be not hammered) will thereby be much softened.

For which knack of *softning* they have also frequent occasion in order to their iron-works, as well as for *hardening*; which they do too with *oil*, *wax*, *suet*, *butter*, *asa-fætida*, *sulphur*, and indeed any fat unctuous body; it seeming to amount almost to an *aphorism*, in *re ferraria*, *durum pinguibus remollescere*; the iron being daub'd
over

over with any of these, and then heated red-hot, and suffered after to cool in the fire by degrees, as it goes out of it self. Thus an ingenious smith of *Oxford* usually softens his iron, first heating it moderately, then daubing it all over with *tallow*, and after heating red-hot, and letting it cool in the fire as it gradually goes out. The iron thus prepared, is used both by the *white* and *black-smiths* of *Staffordshire*, according as the condition of their wares require, being forged by the former into *sithes*, *reaping-hooks*, *axes*, *batchets*, *bills*, &c. (for each whereof they give their iron a different heat and temper) which being ground at the *blade-mills* to a bright edge, they have given this sort of artizans that make them the name of *white-smiths*. And by the latter it is wrought into *plow*, *cart*, and *fire-irons*, into *horse-locks* and *shoes*, *bolts* and *hinges* for doors, *bars* for windows, *squares* for trunks and *coffins*, *staff-heads*, *buckles* and *nails*; for making the last of which, there are so prodigious numbers, that in the parish of *Sedgley* alone, there are thought to be no less than 2000 of the trade, reckoning boys as well as men.

But the greatest excellency of the *black-smiths* profession, that could be learn'd by my author, lies in their making *locks* for doors, wherein the artisans of *Wolverhampton* seem to be prefer'd to all others, where they make them in *suits*, six, eight, or more in a suit, according as the chapman bespeaks 'em, whereof the keys shall neither of 'em open each other's lock; yet one *master-key* shall open them all: so that these *locks* being set upon the doors of a house, and the *inferiour keys* kept by distinct servants, tho' neither of them can come at each other's charge, yet the master can come at them all. Beside, the master
turning

of HUSBANDRY and TRADE. 233

turning his key in any of the servants locks but once extraordinary, the servants themselves cannot come at their charge; neither shall the servant spoil his key or the lock in endeavouring it: For his, after the *master-key* has given the lock a second turn, will only run round in it backward and forward, without either stopping at, or prejudicing it any thing.

Yours,

JOHN HOUGHTON, F. R. S.

FRIDAY, Nov. 19. 1697. NUM. CCLXXVII.

*Curiosity of lock-work. Spur-work and
bridle-work.*

LAST week I told you a great deal of the curiosity of *lock-making* at *Wolverhampton*. It seems they are so curious in *lock-work* (indeed beyond all preference) that they can contrive a *lock* so that the *master* or *mistress* of a family sending a servant into their *closets* either with the *master-key*, or (if they permit an *inferior key*) with their own, can certainly tell by the lock how many times that servant has been in at any distance of time; or how many times the *lock* has been shut for a whole year together: Some of them being made to show it 300, 500, or 1000 times: Nay one of the chief workmen of the town told me (might he have workman's wages) he could make to 10000 times. Farther yet, I was told of a very fine lock made in this town, sold for 20*l*.

that had a set of chimes in it, that wou'd go at any hour the owner should think fit. And these locks they make either with *brass* or *iron*-boxes so curiously polish'd, and the keys so finely wrought, that 'tis not reasonable to think they were ever exceeded, unless by *Tubal-Cain* the inspired *artificer* in brass and iron.

Nor are they less curious in their iron-works at the town of *Walsall*, which chiefly relate to somewhat of horsemanship, such as *spurs*, *bridles*, *stirrups*, &c. in the two former whereof they are so very nice, that neither of them are perfected without the joint consent of the artisans; as in the making of a *spur*, there is first the *head* or *spur-maker*, that makes the body of the *spur*; which he makes either *plain*, *jointed*, *broad*, *narrow*, *wire*, &c. and these with *swan-necks*, *feather-necks*, *rough necks*, or *long*, *short*, or *middle necks*: And all these again either *white*, *sanguine*, or *inlaid* with some metal. Secondly, the *hook* or *button-maker*. Thirdly, the *spur-buckle-maker*, who makes the *buckle*, the *chape*, *tongue* and *roll*. And lastly, the *rowel-maker*, who makes the five, six, seven, eight, or ten pointed *rowels* of iron or steel, which he cuts in a mould at one stroke, making a great many of 'em in a little time, and then files them. They make also great variety of *bridles*, both *snaffles* and *bits*, such as the *wheel* and *jointed-snaffle*, the *neck-snaffle*, *wreath-snaffle*, *prick-snaffle*, &c. to the ends or sides whereof belong these fashions, *viz.* the *Rippon*, *acorn*, *spoon*, *trumpet*, *bobbing* and *knobb'd* end. They make likewise *colt-snaffles* and *trenches*, *cabbinsons* and *musrolls*; which are all commonly made too by different persons, tho' sometimes the same makes 'em all himself. And of *bits* they make the *cannon* or *port-bit*, the half-check'd bit,

of HUSBANDRY and TRADE. 235

bit, the *coach-bit* and *watering-bit*, which are made by one workman and the harness to 'em, viz. the *curb*, *watering-chain*, *bolts* and *rings* by another.

Of *stirrups*, they make a great many sorts; which you may expect next *Friday*.

Yours, &c.

JOHN HOUGHTON, F.R.S.

FRIDAY, Nov. 26. 1697. NUM. CCLXXVIII.

Variety of stirrups, saddle-works, buckles, pots. The manner of tinning iron ware, and way to prevent rust. Curious iron-works in other places.

OF *stirrups* they also make at *Walsal* these several sorts; the *swivel*, *barr'd*, *Rippon*, and *plain stirrup*, and these either with broad or narrow bottoms. They make also all the iron-work belonging to a *saddle*, viz. *swivels*, *bars*, *plates*, the two former being made by one workman, the latter by another; also the great variety of buckles that belong to the pack, and hackney-saddles, such as *jets*, *black* or *oil'd buckles*, *sanguine buckles*, *circingle-buckles*; and all sorts of shoe and garter-buckles, whether round, square, oval or cut buckles, which too, are all or most of them made by different tradesmen. There are divers other buckles also made promiscuously amongst these, such as the *Hester-buckle*, plain and knobb'd for the black; and so the *Poland-buckle*, the *pease-buckle*, *chased buckles*, *Dutch* and *Irish buckles*,

236 *A COLLECTION for Improvement*

buckles, which are brass and made by the *copper-smith*: Who also makes *bosses* of all sorts, *pendants*, *stars*, and *labels*, coach-nails, *studds*, &c. Also they cast in this town iron, copper, and brass-pots of all sizes, in perfecting of which wares, as also of their spurs, bridles, stirrups, &c. they use a great deal of *tin*, which they superinduce over them, to give a better lustre, and preserve some of them from rusting, and prevent others from giving a taste of the metals to things boiled in them.

For the performance whereof they use such methods and materials as each *metal* requires, *viz.* for *iron* they proceed in this manner: They melt in a pan a parcel of *tin* proportionable to their work, and a rateable quantity of yellow *rosin* mixt, which will swim above the *tin* to the thickness of a crown-piece; into which the wares being first soak'd in old sharp clarify'd *whbey* to cleanse them from all filth, and due heated, and then dip'd into this mixture, and shaken about, by mediation of the *rosin* they become tinn'd all over.

For preserving some of their finish'd iron-works from *rust*, such as *sword-hilts*, *shoe-buckles*, *armour*, &c. they use *litharge* pounded and sear'd fine, mix'd with oil of *spike*, and so laid on with a feather: Or if they have occasion to lay by any of these curious wares for a considerable time, such as their curious thorough-work'd *keys*, *buckles*, &c. they commonly bury them in lime powder'd, which being a strong *alkali* repels the relenting of the *vitriol* of *Mars*, which seems to be the only thing that occasions this *metal* to contract rust.

In *Sheffield* in *Yorkshire* they make *knives*, *scissors*, *tobacco-boxes*, and divers other fine iron-wares;
and,

of HUSBANDRY and TRADE. 237

and, for ought I know, with as much curiosity as other wares are made in *Staffordshire*, and at *London*, and divers other places they are very curious: But I have not such particular accounts; yet if any will give it me, they'll oblige their humble servant,

JOHN HOUGHTON, F. R. S.

FRIDAY, Decemb. 9. 1697. NUM. CCLXXIX.

Iron, its composition. It vitrifies and helps to make enamels. Steel-making, its nature. Iron preferable to steel in medicine. The best crocus martis. A guess at the cause of burning mountains, earthquakes, hurricanes, pillars of water, thunderbolts, lightnings, thunder, rains after thunder, and mineral waters, steel medicines, their character.

DR. Nich. Lemery, in his *course of chymistry*, says, that *iron* is a very porous metal, compounded of a *vitriolick salt*, *sulphur* and *earth*, ill digested together, wherefore the dissolution of its parts is very easily perform'd.

Iron in the stone is melted in large furnaces, where having continu'd some time in fusion, it vitrifies, as it were, and much resembles an *enamel* of several colours, and it enters indeed into the composition of ordinary enamels, with *lead*, *tin*, *antimony*, *sand*, the *saphire*, the stone of *Perrigore* (a province in *France*,) *gravell'd ashes*, and the ashes of a plant call'd *kali*.

To make *steel*, he says, plates of iron are stratify'd in a great furnace, with *horns*, *nails*, or *hoofs* of animals, under which a very violent fire is made, the *hoofs* burn and calcine the *iron*; when it is red-hot, and near melting, they draw it out of the furnace, and dip it instantly in cold water, then it becomes *steel*: But making it again red-hot, and letting it cool by degrees, is call'd *untempering*.

Steel is astringent by stool, and aperitive by urine; because the excrement grows hard by having the moist parts separated from it.

He thinks the chief virtue of iron to proceed from its salt; and seeing *iron* is more porous than *steel*, and will yield its salt easier, he prefers *iron* in *medicine* before *steel*.

He says, that the best *crocus martis* that ever was invented, is only the rust of *iron*, made by laying it in dew.

Discourſing about a *crocus martis* made with sulphur and water, he ſays they will flame if ſet over a fire, but be very hot of themſelves, and from a parity of reaſon he concludes, are the burnings of mount *Vefuvius* and *Aetna* with earthquakes and hurricanes, which he thinks make *pillars* of water, *thunder-bolts* and *lightning*, with the great cracks of thunder, which he concludes probable by an experiment, and gives a reaſon for the rains after thunder, and the heat of ſome mineral waters.

His reaſoning, in a great many particulars, is very ingenious; but ſome things are too high for my reach, and who is he, that paſſing thro' the pathleſs ways of conjecture, may not ſometimes miſs the right; altho' I do not ſay this Doctor doth: But to him I refer the reader to judge for himſelf.

Befide

Beside what I have said here, the Doctor has given receipts of a great many generous and brave medicines from *steel*; and not only he, but truly almost all *physick-books* do the like; and generous medicines they may well be call'd, for the great good they do in *green-sickness*, *dropsies*, ill habits of body, and almost every thing. Oft have I seen young virgins that look'd like old tallow-candles, in a small time, with these medicines, look like roses.

Thus have I finish'd my history of *iron*, omitting nothing that I cou'd learn and think proper for me to give an account of; and saying nothing more than what I think is proper for this history. Next week for *Mercury*.

Yours &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, Decemb. 10. 1697. NUM. CCLXXX.

Mercury got from cinnabar; of which there are divers sorts in Gresham-College. The best vermilion. Silver is refined with quick-silver. How brass-vessels are gilded, and looking-glasses foil'd. The best and worst paint. Medicinal uses of quick-silver. It devours metal. The best quick-silver, how to know and purge it.

IN my last I ended my history of *iron*: Now for *mercury* or *quick-silver*, which is esteemed a metal of the *imperfect* kind, and is *fluid*.

R 2

'Tis

'Tis gotten out of a stone call'd *cinnabar*.

There is in *Gresham-College* a mercurial oar, all of one colour, much like that of the *hepatick cinnabar*; but somewhat sadder: Also a rich piece of *cinnabar* of a scarlet colour from *Tyrol*, and a rich piece of *native cinnabar* from *Carinthia*. It weighs about two ounces and two drachms, and is entirely of a scarlet colour.

Another of a *purple*, almost like fine *lake*.

A piece of *black cinnabar*, hard and ponderous, about as big as a lamb's heart, where it breaks is of a shining black.

Another of a shining black, mixed with a sad purple.

The best *cinnabar*, in the *Schemnitz* mines ground with oil, makes a *vermilion* equal to, if not surpassing that made by *sublimation*.

In the *West-Indies* all their silver is refin'd, or else melted down with *quick-silver*. A paste made hereof, with *gold*, is sometimes used for gilding of brass vessels; which being daub'd with the same, and held to the fire, the gold adheres, and the *mercury* exhales. With this the *tin-foil* is made to stick close to the back-sides of *looking-glasses*.

Of *sublimate*, *cerufs*, *juice of lemons*, and *rose-water*, mixed like an ointment, is made that paint, which is both the best and the worst in the world.

In medicine, the great use of *mercury* is in the *lues venerea*; sometimes in the *cholic* and *iliac passion*; and for *worms*, especially those small ones, called *ascarides*, against which, if duly prepar'd, there is no medicine so effectual, or more safe; being prepar'd and mix'd with convenient *catharticks*. 'Tis also very properly used in chronick diseases.

of HUSBANDRY and TRADE. 241

Quick-silver greedily cleaves to, and devours metals, principally gold. The best is the most simple and free from lead, or any other mixture; and I'm told, that some will so exactly mix it with lead and bismuth, that (the whole passing thro' leather) the cheat is hard to find out; but if by distillation thro' a retort, it leaves no filth; or if evaporated in a silver spoon, it leaves only a white or yellow spot, it is then fine and good.

It is purged by straining thro' leather, by washing it in vinegar, or in vinegar with salt, or in soap, or other lees: Or by strong shaking it in a close glass with spirit of wine, by distillation, either alone or with lime; or by amalgamation with gold or silver.

Yours

JOHN HOUGHTON, P. R. S.

FRIDAY, Dec. 17. 1697. NUM. CCLXXXI.

Mercury-mines of Friuli, how deep, and descended. How prop'd. The mineral is as hard as a stone, and more weighty also in soft earth. How the mercury is gotten.

IN my last I gave some account of *Quick-silver*. In Numb. 2. of the Philosophical Transactions, April 5. 1665. Dr. *Walter Pope* hath given an account of the *mercury-mines of Friuli*, a territory belonging to the *Venetians*,
R 3 about

about a day's journey and a half from *Goritia* northwards, at a place called *Idria*, situated in a valley of the *Julian Alps*. They have been in the Emperor's possession one hundred and sixty years; and all the inhabitants speak the *Sclavonian* tongue.

The mine, he and his company went into, being the best and greatest, was dedicated to *St. Barbara*, as the others are to other saints; the depth of it was one hundred twenty five paces, each being more than five of our feet. There are two ways down to it; the shortest perpendicular way is that, whereby they bring up the mineral in great buckets; and by which oftentimes some of the workmen come up and down. The other, which is the usual way, is at the beginning not difficult; and the greatest trouble is, that in several places you cannot stand upright: But after a while you descend in earnest by perpendicular ladders, where the weight of ones body is found very sensible. At the end of each ladder there are boards a-cross to breathe a little. Being at the bottom, they saw no more than before, only whence the mineral came. All the way down, and the bottom, where there are several lanes cut out in the mountain, is lined and prop'd with great pieces of firr trees, as thick as they can be set. They dig the mineral with pick-axes, following the veins: 'tis for the most part hard as a stone, but more weighty; of a liver-colour, or that of *crocus metallorum*. There is also some soft earth, in which you plainly see the mercury in little particles. Beside, there are often found in the mines round stones like flints, of several bignesses, very like those globes of hair taken out of oxes bellies. Some of these are very ponderous, and well impregnated with mercury, others light; having little or none in them. The

of HUSBANDRY and TRADE. 243

The manner of getting the mercury is this: They put the earth into a sieve made of wires, at such distance, you may put a finger between, and in a stream, wash as long as any thing will run thro', and so for a dozen times in finer and finer sieves; the earth that passes not, is laid by it self; in the first of these siftings there will be some *mercury*, but in the last great plenty; and in the rest in proportion. The earth laid aside, is pounded, and the same operation repeated. The finest, out of which can be got no *mercury*, is put into iron retorts and stopp'd, lest it should fall into the receivers they are luted to. The fire forces the *mercury* into the receivers. The officer unluted several, and poured out first good *mercury*, and then a black dust, which upon wetting appeared to be *mercury* also. Then they pound the *caput mortuum*, and renew the operation while they can get *mercury*.

This is the way of producing ordinary *mercury*. An account of the other expect in my next from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, Dec. 24. 1697. NUM. CCLXXXIII.

Virgin-mercury. How water was pump'd. Labourers wages. Diseases they are subject to. Mercury gets into the bodies of the labourers. Much wood is used; and how 'tis carried down. The Emperor's charge and quantity of mercury; also the number of persons working.

THE getting of the best *mercury* promised in my next, is without the use of fire, whether gotten by washing or in the *mines*, where sometimes may be taken up of pure *mercury* two or three spoonfuls, and they call it *virgin-mercury*, and is first esteemed for an *amalgama* of gold; and this put to the fire would all fly away; and common *mercury* would do otherwise.

The engines employ'd are admirable. The wheels (the greatest my author ever saw) were mov'd by the force of water brought thither in no chargeable aqueduct from a mountain three miles distant, and the water was pump'd from the bottom of the mine by fifty two pumps, twenty six on a side, and so contrived as to move other wheels for several purposes.

The labourers work for a *Julio* a day, which is not above six or seven pence, and endure not long; for altho' none stay under ground above six hours, all of them in time become *paralytic*, and die *hætic*.

of HUSBANDRY and TRADE. 245

My author saw a man that had not been in the mines for above half a year before, so full of *mercury*, that putting a piece of brass in his mouth, or rubbing it in his fingers, it immediately became white like silver, and he was so *paralytic*, that he could not with both his hands carry a glass half full of wine to his mouth without spilling, tho' he lov'd it well.

He was also inform'd that those who work on the back-side of looking-glasses are also very subject to the *palsie*.

They use exceeding great quantity of wood, in making and repairing the engines, and in the furnaces (whereof there are sixteen, each carrying twenty four retorts) but principally in the mines, which want perpetual reparation, the fir-trees lasting but a small time under ground.

They cut down their wood, and convey it into a valley, and with some of it make a strong dam to stop the water from springs, rain, or snow; and when there is water enough to float the trees to *Idria*, they open the flood-gates, and all are carried thither, where the bridge is built very strong, and at very oblique angles to the stream, on purpose to stop 'em, and throw 'em on shoar near the mines.

These mines cost the Emperor heretofore seventy or eighty thousand florins yearly, and yielded less *mercury* than at present, altho' it costs him but twenty eight thousand florins.

In the year 1661. there was gotten of ordinary *mercury* 198481 l. Of virgin *mercury* 6194 l. In all, 204675 l. In anno 1662. ordinary 225066 l. virgin 9612 l. In all, 234678 l. In anno 1663. ordinary 244219 l. of virgin 11872 l. In all, 255981 l.

There

246 *A COLLECTION for Improvement*

There are always at work two hundred and eighty persons; and all this mercury is gotten from the mines of *Idria*. Thus far about mercury-mines. Next week expect more from

Yours, &c.

JOHN HOUGHTON, F.R.S.

FRIDAY, Dec. 31. 1697. NUM. CCLXXXIV.

Mercury globular, *therefore fluid. Cause of gravity. Heavy bodies will fly by fire. Air will do great things. Fire, its quality. Cause of redness in fire. Fire is like water in a pump. How such water rises.*

IN my last I gave an account of the mines of *mercury*. Now I shall take some notes about it from Dr. *Lemery*, who calls it a *prodigy* among metals; for 'tis fluid like water; and tho' a very heavy body, yet it easily flies away when set over the fire.

He thinks it probable that its parts are all round; for in all parcels, if alone, it keeps a globular form; and when 'tis dissolv'd in *aqua fortis*, an infinite number of round bodies arise in the liquor like smoak.

For this roundness sake the parts cannot cleave one to another; therefore they must roll, and are fluid, and rise so easily by heat; and I myself suppose the globes to be infinitely small, but
massy

of HUSBANDRY and TRADE. 247

massy and compact, as he says, which makes the gravity, altho' the smallness makes 'em light enough to fly by the force of the fire; and for ought I know *quick-silver* may by fire be expanded, or made hollow as bubbles of water are, by which they are made lighter, and may more easily ascend, altho' this I do not affirm.

But if they be not made hollow, why may not fire drive them up, especially so little way as to the head of a retort; when if foot be examin'd, I doubt not but there will appear heavier bodies than these can be supposed, and out of the chimney will fly much heavier.

I have seen fire in a chimney turn a jack that has been set above it; and wind-furnaces will send up great weights according to the length of the air-pipe, bigness of the fire, and straitness of the funnel. The great fire of *London* sent large heavy bodies divers miles, as 'twas commonly reported. What mighty things will pent-up-air do? And fire I take to be only a quality that separates the light *aerial* substances in matter, from the more gross; and if a great deal be done in a very little time, the quickness of the motion makes heat, and those fine particles going together without the grosser, makes appear that redness we call *fire*, and it carries up weighty things according to the degree of the fire.

They that understand how pumps work, may, in a great measure, apprehend how fire burns.

The *atmosphere*, or region of the air, I suppose to be bounded, and to have air enough just to fill it to a certain degree of closeness; yet not so close, but that it may be compress'd closer, and so much as it is, so much there will be a vacuity in some other place, and so much will be a springiness tending towards its former constitution.

248 *A COLLECTION for Improvement*

This *atmosphere* will not allow water to arise in a pump above thirty three feet or a little more. Now that space that is between the water and the bucket is air; and if by lifting up the handle the bucket goes down, the air forces thro' the valve of the bucket, which shutting keeps it there. This air makes a pressure in the rest; and that presses more water to the other in the well, and that having not so much air to keep it down as it had, easily rises up as high as the evacuated air gives leave; and so as more air is taken out, more water will follow, till all the air be gone, and the water it self comes, and then one water will follow another *ad infinitum*, unless the circumjacent water ceases, or the pump is work'd faster than the channels of the earth will give leave for fresh water to come in. Even so fire in my next from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, Jan. 7. 1697. NUM. CCLXXXV.

How fire burns. How fire will burn without bellows. How æolipiles work. How cinnabar is made. Its proportions. What quick-silver is good for.

IN my last I shewed how *pumps* raise water; even so fire burns; for when fuel is kindled, the fire rarifies some part of it, and makes a degree of vacuity there. This rarified fuel takes up

of HUSBANDRY and TRADE. 249

up room, and presses the outward air, which runs where it finds least resistance, viz. into the cavities of the fuel, but coming with the same force, the smoke flies, it blows the fire, and kindles more fuel, which sends up more smoke, till the matter making smoke be lessened.

But we are more sensible of the smoke than the air; because perhaps the air has ten or more times the room to come to the fire, as the smoke has to go from it, but in furnaces where the air is shut out from all places but the bottom, there needs no bellows to make the fire burn or roar; also in wind-furnaces that bring the air in long pipes; and this makes the use of bellows, and they that sit between a door and a good fire, where the wind may come in a strait line, are sensible of this.

I doubt not but a run of smoke, if carried up a four inch funnel in a minute's time, will carry up things of four times the weight, it will do in an eight inch funnel; because that is four times as big. Thus in an open fire.

But fire may be kindled and increased by water in an *æolipile*, which is something like an iron retort: This being fill'd with water, and set on a fire, will blow another fire with great violence, according to the heat of the fire it stands on, till all the water be evaporated; even so (I doubt not) will go the particles of *quick-silver* (tho' they seem heavy) by help of a good fire.

What Dr. *Lemery* and some others speak of *igneous* particles getting within the pores, when there is the retort between the fire and the mercury, I cannot apprehend, altho' it may be different in an open fire, as in *red lead*, &c.

'Tis call'd *quick-silver* from its fluidity.

'Tis

250 *A COLLECTION for Improvement*

'Tis to be found in *Spain, Poland, Hungary,* and *France*, near *St. Leo* in *Normandy*.

Cinnabar my author supposes to be made of *sulphur* and *mercury*; because with those can be made such like, as he shews how. I believe 'tis this factitious *cinnabar* is sold in the shops, which is very red, useful in *painting*, for the *itch*, and to make *fumes* with to raise *salivation*.

'Tis one part *sulphur*, and three parts *mercury* sublimed together, and supposed, that the angular *sulphur* gets between the globules of *mercury*, and so fixes them; but by adding lime or filings of iron to imbibe the acid parts of *sulphur*, you may distil the quick-silver clear from it, and in the purity of this you may confide; because adulterations will not sublime.

Quick-silver is one of the greatest remedies we have in physick, if used by the skilful; but by the ignorant it may do great mischief. It is given in the *iliac passion* by two or three pounds together with good success, when a small quantity might stop, and be fix'd with some acid. All unguents and plaisters mixed with it, are good against the *itch* and *tettars*, and dissolve *cold tumours*. Next *Friday* expect more of it about venereal maladies, from

Yours,

JOHN HOUGHTON, *F.R.S.*

FRI-

FRIDAY, Jan. 14. 1697. NUM. CCLXXXVI.

*The manner of fluxing, and reasons thereof.
Mercury globular and volatile. The nature of globes. What is alkali. How mercury operates.*

LAST week I promised an account of *mercury* in *venereal diseases*; for cure of which there is no remedy found like it, tho' sometimes scurvy consequences do happen upon it. 'Tis kill'd with turpentine, then mix'd with ointments, which by friction causes *salivation*, as is done by *mercurial plaisters*, *fumigations*, and taking several preparations inwardly, the manner of doing which I leave to the artist; because others should not meddle with it.

This learned Dr. *Lemery* endeavours to give the reason how *mercury* fluxes, thinking, with other physicians, that the nodes and other effects of the *venereal poison*, are fomented by saline or acid humours, which make a certain ferment: And that this disease cannot be cured till this poison be destroyed, which must be by *alkali's*; but the fix'd *alkali's*, such as *pearl*, *crabs eyes*, &c. meet but with a few of those saline parts, and therefore tho' they may sometimes ease, yet they will not eradicate this disease: But *mercury* being a *volatile alkali*, flies by the warmth of the body into all parts, and meets with it every where, subliming it to the head, the top and coolest place, and so most proper to condense them.

Some-

252 *A COLLECTION for Improvement*

Sometimes meeting with other *alkali's*, that draw some of the *acids*, they are carried off by *stool, urine, or sweat*, which hinders the fluxing.

This solution of his hypothesis is very pretty, and, for ought I know, true: But methinks he has not explain'd it so well as might be. I'll give my thoughts, but submit them.

I think none doubts but mercury will enter the body thro' the pores, as well as thro' the mouth: Witness fluxing by ointments, &c.

Mercury, as has been shewn, is globular, and will be volatilized, when duly prepared by the gentle heat of the body.

A globe is a figure so constituted, that if it be laid on a perfectly smooth plane, 'tis the least part imaginable, or rather a point of the round that will touch it; for if more parts than one could, there 'twou'd be a plane and not a globe. Then when globes fly by warmth, they'll penetrate as wedges, according to the degree of strength they are sent up by. The blood and humours are made of heterogeneous or different parts, some thick and some thin as milk is. Globes, when together, cannot fill up a space, but there will be hollowneses between 'em; for a barrel full of shot or bullets will hold water beside. Wherever there is a vacuity, there the air strives to press matter in, as I shewed in my last about fire, and the former about pumps: And this vacuity perhaps it is we call *alkali*.

Mercury, when it flies, leaves what was between its globes, and these meeting again, want something to fill the hollowneses; and some of the salts are press'd in: These leave the rest of the matter they were in more fluid, as rennet, fixing the salts in milk, makes the thin whey appear,

pear, and 'twill run thro' less pores; even so the liquor left by the *solid parts*, got into the *mercury*, is more fluid, easier separates, and so is cast out by *spitting*, or any other *evacuating places* it comes next to. This liquor, I presume, carries off some salts, and the other is carried off by the *mercury* it self, for if that should not go off with the evacuations, I presume the *mercury* wou'd still fly, as long as warmth lasted.

Yours,

JOHN HOUGHTON, F. R. S.

FRIDAY, Jan. 22. 1697. NUM. CCLXXXVII.

Sublimate, *how made and counterfeited*. Red precipitate, white precipitate, yellow precipitate. *How these will alter colour*. Poison, *its definition*. *Its different sorts, effects and antidotes: contagious diseases thought from hence*. Sublimate stronger than arsenick. *How mercury may be reviv'd*.

IN my last I shewed the reason of *fluxing*. My author shews the making of *sublimate*, with curious remarks on it, to which I refer you, but cannot pass by his proof of true or false *sublimate*; rub the true with *salt of tartar*, and it turns *yellow*; but if 'tis made with *arsenick*, 'twill turn *black*.

If you dissolve *sublimate corrosive* in water; then filtrate, and put the liquor into three viols,
 VOL. II. S and

254 A COLLECTION for Improvement

and put into one some drops of oil of *tartar per deliquium*, you'll presently have a red *precipitate* that you may dry and use; but if you drop into the other viol the volatile spirit of *sal armoniack*, you'll have a fine *white precipitate*. And if you pour into the last of these viols some *lime water*, you have a yellow water called *phagedenick*, or water for ulcers; if you let the liquor settle, it will let fall a *yellow precipitate*.

If by way of curiosity you should drop into the viol of *red precipitate* some spirit of *sal armoniack*, and would shake the liquor a little, it would presently turn white, and the *precipitate* would be white: But if instead of spirit of *sal armoniack*, you would use spirit of *vitriol*, an ebullition would rise in it, and the red liquor wou'd become clear and transparent as common water.

Fresh oil of *tartar*, and spirit of *sal armoniack* dropt in, will cause new *red* and *white precipitates*, which may be dissolv'd, and the liquor made clear again by adding a larger quantity of spirit of *vitriol*.

All alkali's break and destroy acids; but with difference they do so dispose the parts of the precipitated body, as to capacitate them to make different refractions of light.

I presume these things must be very well considered, before we can have a good history of colours.

My author farther strives to shew what *poison* is, and defines it to be whatsoever is able to break and destroy the oeconomy of the body, and the orderly connection or derivation of humours; or else to hinder the natural course of the spirits.

It may be taken outwardly from the air, or bites, or inwardly, as when one takes *arsenick*, *sublimate*, *hemlock*, *wolf-bane*, &c.

Every

of HUSBANDRY and TRADE. 255

Every thing is not poison alike to every creature: For *nux vomica* kills dogs, yet hurts not many other beasts. *Tobacco-smoke* kills vipers presently, yet gently purges other creatures. Water, wherein *quick-silver* has been infused, kills worms, but does good to other animals. *Arsenick* kills a man, and divers other creatures, yet only purges a *wolf*.

Poison has two effects; the one coagulates the blood, as the *viper*, *tarantula*, *scorpion*, *hemlock*, *wolf-bane*, &c. or *acid liquors* syring'd into the blood-vessels. The other, as *sublimate* and *arsenick*, tears and excoriates the viscera by their pungent salts, until they come to gangrene, and then they die.

The first are help'd by *volatile salts*, animals abounding therewith, and *opiates*.

He fancies the *small-pox*, *plague*, *malignant-fevers*, and such like, to be of the first rank, tho' more mild, and they are help'd by the like remedies.

The second sort of poisons are help'd by calming the humours, and voiding them, which is done by evacuating with *oil* or fat things, either upwards, or downwards, or both; and afterward for some days to drink warm milk, after which purging is again good.

Sublimate, by reason of the volatility of the mercury, is a quicker poison than *arsenick*.

All the *precipitates* as *sublimates* may be revived into following mercury, by mixing them with *lime*, and distilling them; because the *alkali* of lime destroys those acids that disguised the *quick-silver*.

Yours, &c.

JOHN HOUGHTON, F. R. S.

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FRI-

FRIDAY, Jan. 28. 1697. NUM. CCLXXXVIII.

*What quick-silver was imported 1694.
Notes upon industry. Destruction of
wood.*

OF *quick-silver* there was imported at *London* in the year 1694 from *Holland* 9115 pounds; of *mercury* prepared twenty pounds, and of *sublimate* twelve pounds, besides 1786 pounds of *vermilion*.

In *Holland* is not produced one grain of this *quick-silver*; yet in time of war, that year we imported not one grain from any place but thence; which makes me admire that industrious people, who always keep magazines sufficient to supply themselves and neighbours in times of necessity: And this makes me almost doubt whether 'tis best building a city with a good port, in a country that abounds with many, or but few things, and I am almost for the latter: For this will make a necessity (the mother of invention) that an industry, which supply them with all the good things the universe produces, both for themselves and others.

Something like this I have hinted before in my second quarto volume, Numb. 3. Nov. 6. 1683. where I plead for the destruction of wood within twelve miles of a navigable river; on which ground I am sure more profitable things may grow, even to supply us with twice as much *fuel* and *timber* as we had from thence, besides the encrease of employments upon those grounds, and

and the ships and seamen will be employ'd into the bargain; also the collateral trade for our growth and manufacture, such a navigation would produce.

Beyond the natural inference, I mention this now; because the *House of Commons* have at this time the encrease of wood in the *New-Forest* under their consideration. I could wish that some of the most zealous for the welfare of our Country wou'd consider what I have there said, and that some one or other wou'd fairly give answer to it.

But truly this has been printed fourteen years: A great many opponents I have met with have been convinced; some have followed my advice, as they have owned; and others have grubb'd up their woods from some arguments I know not of. But however, more woods have been destroyed than planted; and I believe I shall never see a law for the turning arable or pasture to wood, which we ought to endeavour for, if that be best.

I have little more to say about imported *minerals*, only that there came from *Holland* thirty eight hundred of *bole armoniack*, and of common *bole* twenty eight hundred, and three hundred from the *Streights*. Of *tarras* from *Holland* 2193 barrels, and of *plaister of paris* from *Guernsey* fifteen tuns. Of *parilla*, with which they make glass from *Dantzick* 70. *Holland* 120. *Portugal* 240. *Spain* 10345. *Canaries* 240. The *Streights* 450. In all, 11465 hundred: And so much for *minerals*.

Yours, &c.

JOHN HOUGHTON, F.R.S.

FRIDAY, February 12. 1697. NUM. CCXC.

*An epitome of the eleven volumes. A
division of plants.*

IN my first volume is the nature of *earth, water, air, and fire*, with their effects, and reason of many of their operations: In my second, *natural history*, with the *taxes, acres, houses, &c.* in each county of *England and Wales*, with notes, particularly of *Yorkshire and Derbyshire*: In my third, the doctrine of *fermentation*, history of *cyder and clay*. In my fourth, a continuation of *clay*, and all its uses I could learn, with the history of *wheat*: In my fifth, the history of *joint-stocks and kine*: In my sixth I went on about *kine*, shewing the use and manufacture of most parts, the doctrine of *nutrition, circulation* of the blood, with reason of its ascent, and manner of growing of *bones* and other parts: In my seventh I have carried on the history of *kine* in discourses upon *blood, butter, cheese, cows, cream, dung, milk, urine, whey*, and other particulars: In my eighth is an account of the ships that came from abroad to *London* from *New-years-day 1694*, to the same day *1695*, with the number from each Prince's territories; and of all the goods imported that year, mentioned in the bills of entry, with the quantities from each place, and all together.

Upon these I have made some notes *natural and political*, as the advantage of a *coalition* with *Scotland*, the true case of a *free-trade*, a *regulated company*,

of HUSBANDRY and TRADE. 259

company, and a *joint-stock*, with an easy and certain method for mending the roads, &c. In my ninth are histories of imported *stone*, *glass*, *salt*, and a farther account of roads: In my tenth, a farther account of *salt*, the history of *nitre*, *gun-powder*, profits of the *indian* trade; history of *vitriol*, *copperas*, *brimstone*, *okre*, *jett* and *coal*: In my eleventh are the farther histories of *coal*; also of *arsenick*, *lapis hæmatites*, and the seven metals, with a description of all things I could learn were made from them, with some discourses about *air*, *alkali*, *colours*, *exchange*, *fire*; the manner of fluxing with *mercury*; *money*, *poison*, *trade*, *pumps* and *wood*: In this twelfth I shall begin the history of *vegetables* imported, and go on as well as I can, endeavouring to make it the best account of *trade*, upon the best and most sure foot that ever has been yet published, and I could hear of: And all this I have applied and will apply for the benefit of my country, not doubting but it may be made the richest and happiest the sun sees.

Vegetables or *plants* may be distinguished into such as are, First, more *minute* and *tender*, called *herbs*; to be consider'd according to their *leaves*, *flowers*, *seed-vessels*. Secondly, *large* and *hard*, being *woody-plants*, whether the lesser, which commonly grow up from the root in several stems called *shrubs*. *Larger*, which of themselves do grow up in one single stem, called a *tree*.

Herbs consider'd according to their *leaves*, may be distinguished into such as are *imperfect* and *perfect*; which last is to be distinguished, First, by the fashion of the leaf. Secondly, by the texture of the leaf. Or, Thirdly, by the *superficies* of the leaf. And the fashion by be-

260 *A COLLECTION for Improvement*

ing long or round, and the long, as all graminious herbs (having a long narrow leaf without any foot-stalk) by *not flowering* and *flowering*; and the *not flowering* by being *frumentaceous* (such whose seed is used by men for food) or *not frumentaceous*. And the *flowering* (by being of *bulbous roots* (having no fibres but only from the bottom or top, whose leaves are more thick, undivided, smooth-edg'd, and generally deciduous) or of *affinity to bulbous roots*.

Herbs are also distinguished by the texture of the leaf, being either *nervous* (having several prominent *fibres*) or *succulent* (having thick juicy leaves covered with a close membrane, through which the moisture cannot easily transpire, which makes them continue in dry places.

Herbs are also distinguished by the *superficies* of the leaf, or manner of growing.

Next *Friday* I shall begin to particularize such as have been imported as merchandize, and am

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, February 19. 1697. NUM. CCXCI.

Imperfect herbs describ'd. How many mushrooms imported anno 1694. Variety of sorts. Their use.

Imperfect herbs may be distinguished into *terrestrial* and *aquatick*; and the *terrestrial* are most *imperfect* and less *imperfect*; and the most imperfect

imperfect (which seem to be of a spontaneous generation) are such as have *no leaf*, and have a *leaf*. Those having *no leaf*, are with a *stem* and *head*, and without a *stem*. Those with a *stem* are the greater, as *musbroom*, *toad-stool*, *fungus*, *touchwood*, *spunk*; or less, as *mould*, *borines*, *vine-w*; and this last hath by Mr. Hook been first discovered to consist of small stems with little balls at the top, which flitter off when ripe.

Of *frogstools* or *musbrooms* there was imported from Germany in the year 1694, one barrel 86 l. and certain.

Of these Mr. Ray, in his history of plants, makes four sections, dividing the first into two members, and of the first of them, *viz. lamellated terrestrial musbrooms* fit for food, he makes twenty four sorts. Of the second member, *viz. lamellated terrestrial hurtful musbrooms*, he makes thirty five sorts.

His second section is of *terrestrial musbrooms not lamellated*; of these he makes eighteen sorts.

His third section is of *tree-musbrooms*; of which he makes fifteen sorts.

His fourth section is of *subterranean musbrooms*.

Of those that came from Germany, I presume their chief use is for *sauc*, and they are dried in an oven, and powder'd: These are *fry'd*, *pickl'd*, and what not.

There are other *most imperfect* herbs having no leaf, without a stem, of a roundish figure, growing either in the ground, being eatable, and counted a great delicacy; or on the ground, being, when dry, full of unfavoury hurtful dust; such as are *trubs*, *truffle*, and *fuzball* or *puckfist*.

There are *most imperfect* herbs having a leaf, growing in such barren places where no other herbs will thrive, either that which grows on ground,

262 *A COLLECTION for Improvement*

ground, walls, and trees; of which there are great varieties; or that which grows only in *moist* grounds and *shady* places; as *mos*s and *liverwort*.

There are also *less imperfect* herbs, whose *seeds* and *flowers* (if any) are scarce discernible, commonly called *capillary plants*, whether such as have several leaves, or but one leaf, and are *divided* or *undivided*, and the divided are doubly, or subdivided, or singly: and the doubly are greater; as *fern*, or *brake*, and *oak-fern*, or *lesser*: Either that which grows in moist shady places, having small slender black stalks; as *white maiden-hair*, *wall-rue*, *tent-wort*, or *black maiden-hair*.

The *singly* are the *greater*, of a broader leaf and purgative root; or, of a narrower and longer leaf; as, *polypody* and *rough spleen-wort*.

And the *lesser* are either that which hath a black stalk and winged leaves like a *vetch*; or what hath a thicker shorter leaf not divided to the middle-rib; such as *English black maiden-hair* or *spleen-wort*, *miltwast*.

The *undivided*, whose leaves are somewhat broader towards the bottom; or *more equal*; as, *male-fern* and *harts-tongue*.

Also there are such as have but *one leaf*, either that like others of this tribe, with a tuft of very small flowers; or that hath an *undivided succulent* leaf, with a small spike standing off from it, as *moon-wort* and *adders-tongue*. Next week for *Aquatics* from

Yours, &c.

JOHN HOUGHTON, F.R.S.

FRIDAY, February 25. 1697. NUM. CCXCII.

A description of aquatick and graminious frumentacious herbs. How much wheat, and wheat-meal, and flower imported to London from abroad, anno 1694, 1695.

NOW for *aquatick* herbs belonging to fresh water (which consist of small round leaves floating on the top, or immers'd, having little strings shooting down: Or, which consist of long small *filaments*, resembling green raw silk, as duckweed, and hairy riverweed) or *salt-water*; being of a softer or harder consistence: The softer having some resemblance to *mushrooms*; either the *greater*, being more round and thick, with pores every way; or the *less*, having long slender stalks with *round leaves* growing at the top; as *spunge* and *sea navel-wort*. Or, having some resemblance to *moss*, or *ground-liver-wort*, having green curled leaves spreading on the ground as *sea-lettuce*. Or having some resemblance to *mushrooms* and *moss*, either what is flat and roundish, hard and tough, with several lines parallel to the circumference: Or, whose leaves grow out of one another without any stem; as, *sea-ear* and round leav'd *oyster-weed*. Or, having some resemblance to capillary plants, having a soft *membraneous tough leaf*, growing commonly on stones and rocks in the sea.

Those *aquaticks* of a harder consistence being tough, with many *fibres* or *ribs* elegantly distributed

buted, somewhat like the meshes of a net, growing to a great breadth; as *sea-fan*.

Of all these, since the mushroom, I find no entry.

Now I come to the *perfect herbs*; and *graminious frumentacious* may be distinguished into such, whose seeds are greater and lesser: The greater being covered with a *thin membrane*, without any *husk* adhering; or with a *husk*. The first of a figure *oblong*, of a more *turgid* grain and *brighter* colour, every seed in the ear being covered with three loose husks, or that which bears a more black, lank, oblong seed, having always a beard adhering to the husk of each grain in the growth; as *wheat* and *rye*: Or roundish and somewhat compress'd; being the biggest of this tribe, the ears growing out of the side of the stalk, the top having a chaffy panicle without any seed; as *maize* or *Indian wheat*.

The greater being covered with a husk, growing in a *spike* or *panicle*; that in a spike whose grains are bearded, their husks adhering close to them, being the lowest, or whose grains are more *turgid* and *round*, growing at a greater distance in a kind of compounded ear, which seems to consist of several lesser spikes; as *barly* and *rice*: That in a *panicle*, or dispers'd tuft, at a distance from each other, upon long weak stems, not above two together hanging down, as *oat*.

Those *graminious frumentacious herbs*, whose seeds are *lesser*, growing in a *spike* or *panicle*; those in a *spike* or *ear* having short beards, the grain being of a *yellowish* colour as *panick*: Those in a *panicle* or tuft, having a roundish shining seed, which is a more tall large plant, whose panicle stands upright: Or, which is a more less plant, whose *panicle* hangs down; as *Indian millet* and *millet*.

of HUSBANDRY and TRADE. 263

Of these there was imported to *London*, anno 1694, 1695. of *wheat* from *Holland*, quarters 8842. From *England* some place, where before 'twas imported, quarters 1527. *Holstein*, quarters 3060. *Ireland*, quarters 66. *Denmark*, quarters 878. *Flanders*, quarters 848. *Sweden*, quarters 1971. *Germany*, quarters 839. *Scotland*, quarters 7650, two casks, one last, and three barrels; in all, quarters 25681, two casks, one last, and three barrels. Also wheat-meal and flower from *Dantzick*, lasts 23. *Denmark*, lasts 8. *Ireland*, casks 1. *Spain*, casks 15. *Germany*, bushels 9. *Scotland*, barrels 36, bushels 47, lasts 24, quarters 22, casks 61. In all, 55 lasts, 77 casks, 36 barrels, 22 quarters, and 47 bushels. Next week expect more of wheat from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, March 4. 1697. NUM. CCXCIII.

How much wheat imported. Encouragement for importation and exportation. Advantages of the dearness of corn. The wheel of trade. The King's interest to pay for exporting corn. Advantages of selling all corn by weight.

IN my last I gave an account of 26000 quarters of *wheat* in *grain*, *meal*, and *flower* that was imported to *London*, anno 1694, 1695, and the places from whence it came.

I am

I am now to consider the policy of its *importation*; and the case is thus: Our law lays high duties on imported corn, when under a certain price (wheat six shillings) but abates when above that price. Without doubt this act was well considered to encourage our own product, and to keep us from extremity in times of *dearth*: The King also gives money for its *exportation*, when 'tis very *low*.

'Tis the dearness of corn that encourages the farmer, not only to pay his rent well and give good prizes, but also to live high and improve all his unimprov'd land within his reach, which will still encrease *trade* and *revenue*, and the necessity will make the *manufactors* work harder, and that will encrease *manufacture*, and that will make us sell cheaper, till we have gotten so many new, or so improv'd our old customers, as that our quantities will not serve.

Anno 1683, June 16. in my second 4^{to} volume, N^o 6. I offer'd to make it appear, that this kingdom will thrive more, and the manufactors live better when provisions are *dear* than *cheap*. There I shew'd that *plenty* or *cheapness* caus'd *laziness*, that *deariness*, that *industry*, and that *plenty*; and also 'twas good to encourage the people to a *high living*, and the conveniencies of it: That if the manufactors can't live as they use to do, by three days in a week working, they must work four, or find some quicker way, and that will produce a fourth part of more manufacture, which must cause it to be sold cheaper.

I there also shew'd how 'twas the King's interest to give money for *exporting* corn, and our interest to have the excise *higher*, and a duty not only on brewers, but on all that brew. These two last hints have been followed in raising the
I
excise

of HUSBANDRY and TRADE. 267

excise and the *malt-act*: and to the book it self I refer.

The use I would make of what is aforesaid, is, to have the great ones consider if it would not be advantageous to make the encouragement for bringing in of corn, not for six but seven shillings, and to give a greater encouragement for its exportation, which would always keep land at a good price.

I understand there is now in the house of commons a bill depending for *ascertaining* of measures.

Without doubt were this brought to perfection, 'twould be an advantage to a great many. The publick revenue would be more certain; also the small dealers of least design, and the carriages. But seeing corn differs very much in goodness, I submit it, if it would not be better to have it all sold by weight as salt is; for so the cunning meal-man sells, and must consider it. This would encourage the farmer to improve his land to get heavy corn; for his light, tho' it made more bushels, would not avail him. I know 'twould make some little inconveniences at first about *malt*, where the heaviest often is not enough malted: But a little time and experience would cure this: And by knowing what a good bushel of malt weighs, may be known when 'tis well malted. *Rice*, *French barley*, and most other *seeds* are thus sold; and why our corn may not, I cannot see. Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRI-

FRIDAY, March 11. 1697. NUM. CCXCIV.

*The contents of what was formerly writ of
Wheat. Granaries. The form of them.*

IN my last, with other things, I shew'd how much wheat was imported; and 'twas best to sell it by *weight*.

In my fourth volume I have given a large account of *wheat*. I shall here only give the contents, and refer thither, where is its description, name, sorts, where it grows, what soil best, when sown. It grows to the height of a pike, the best, other qualities, the best for food and medicine, thirteen sorts. A proposal. If set in the spring, it runs all to straw. A farther use for medicine. Its culture and best dung. How much to an acre. Folding and other dungs for wheat. How much wheat to an acre. What best. How order'd and secur'd. Green wheat, why eaten, dry ears good. Clods broken. Its weeding, securing from birds. Reaping, hardening, sheafing, housing, and thrashing, securing from vermin. Best way of keeping and securing for an *Indian* voyage. How many grains in a bushel. How much to an acre. An acre may produce twenty six quarters. Its management before setting. Four thousand grains from one root. Seven sorts. Raining wheat, what. Thirty quarters from an acre. Wheat, its parts and use, manner of dishing, buttering, frumenty, coffee, malt. Meal makes good bread. 'Tis divided in-

to five sorts. Its uses. Household bread, when bak'd enough. Stale bread, how made new. *French* bread. Leavened bread, how long in baking. Best household bread, *London* bread. Miscelan much eaten. Finest flower, its uses. The nourishment of the plant, in it the oil, spirit and plant it self. Reason of moisture in fine bread. Rowls. A seed and plumb-cake, pufte-paste, pancakes, fritters, wafers, *Dutch*, hasty-pudding, bak'd and boil'd pudding, biskets, ginger-bread, grudgeons. Chaff, its uses. Straw, its uses. Red and grey poll-revet-wheat. Egg-shell and mousedun wheat all one.

And now what is more to be said, except whether 'tis best or no, for *England* in cheap years to erect *granaries*, for storing up large quantities; and I am inclinable to think not. We have the practice of our country on my side, notwithstanding we have formerly tryed: For I remember when our companies used to take corn-money of such were made free, and 'twas design'd to keep stores in each hall; but I do not hear of a grain kept there now; and shou'd such store be kept, 'twould keep corn cheap, and by discouraging the farmer hinder its encrease, and keep down rents; and, as I have said already, 'twill hinder the poor from work, and lessen our manufacture, altho' 'tis possible that in countries where the Lords make the people their slaves, and keep them always in necessity, it may do well enough; or in such countries where the people are necessitated by great excises, and are apt to be tumultuous, if their governors do not take care for 'em in this affair.

But for those that will have *granaries* (and I believe we shall have such when people find it their interest) Captain *Yarranton*, in his *England's*

270 *A COLLECTION for Improvement*

improvement by sea and land, printed 1677, and sold by *T. Parkhurst* in *Cheapside*, gives a description, saying, it shou'd be three hundred foot long, eighteen foot *wide*, and lime within the walls, seven stories high, each seven *foot* high built with burnt brick and sand, the ends must be north and south: In the sides there must be large windows to open *well* and shut close. When these be open, and the corn stirr'd, the dust *will* fly as the wind fits. In fair weather they must be open to have the corn dry, and in other weather they must be shut, and a fire must be in stoves in the middle, to keep all dry. There must be troughs or spouts to throw it from the upper granaries to the *lowest*, and into the Barges: And cranes to return it when need be: And the charge of this at his *new Brunswick* or *new Harlem* he reckons at 820 *l.* but 'twill keep 14000 quarters of corn; and six labourers *with* one clerk will manage all, and their wages he reckons at 120 *l.* *which* with 80 *l.* the interest of the first charge at 10 *per cent.* the yearly charge *will* be 200 *l.* and 6 *d.* the quarter for keeping the 14000 quarters is 350 *l.* the year, for granary-rent. The author is much larger: But thus much for *wheat*. Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, *F. R. S.*

FRI-

FRIDAY, March 18. 1697. NUM. CCXCV.

Rye described. How it grows. The best way to keep Rye. Its farther history and quantity imported.

IN my last I ended the history of *wheat*; now for *rye*, which is a *gramineous frumentacious* herb, whose seeds are of the greater kind, and covered with a *thin* membrane, of a figure oblong, which bears a more *black, lank, oblong* seed; having always a *beard* adhering to the husk of each grain in the growth.

Mr. *Worlidge* saith, *rye* is a grain generally known, and delighteth in a dry warm land; but will grow in most sorts, so the earth be well tempered and loose: It needeth not so rich ground, neither care nor cost as *wheat*; only it must be sown in a dry time, for rain soon drowneth it, even in the *hopper*, as the saying is. It is quick of growth, after it is sown, and sooner in the ear, (usually in *April*) and sooner ripe than other grain; yet in some places they sow and reap *wheat* and *rye* together; but the *rye* is first ripe; neither does my author understand why they sow them together.

The chief season of sowing *rye* is about *September*, but with some difference according to the nature of the ground.

Some say the best way to keep *rye* is to keep it on the plaister-floor, and to turn it often; or sometimes to tread it hard into dry vessels, that are close and very sweet: But I have heard say,

that to thrash it (or other corn) and to keep it on the floor with its chaff, is most excellent; for that moisture which would go otherwise into the corn, is imbib'd into the dryer chaff, and then in dry seasons sooner dried out again, and so *toties quoties*.

Mr. Ray tells us, that *rye* is called *secale*, à *secando*; because 'tis cut down.

Rye differs from *wheat*, by being more *lean*, *thick*, and *black*, not covered with *husks*, but *bare*, and with a *high* stem.

It has many small fibrous roots. When it first puts forth leaves, they are *reddish*, afterwards *green*; they are more narrow and long than those of *wheat*. It has six, seven, or more stems (and if it grows unhurt by wet before winter, it roots well, and sometimes will bear a dozen ears.)

The stems are more *thin* and *long* than those of *wheat*, and out of a rough gramineous or arundinaceous sheath distinct ones come forth with (for the most part) four, sometimes five joints, having the ears disposed downwards, with short beards not altogether harmless, but as it were with some saw-like little hooks, as has been noted in the beards of other corn. Therefore let people take care how they put them to their mouths.

'Tis of a *yellowish* flower, as is observ'd in most bread-corn. It *flowers* long, and five weeks after the *flowers* are gone, 'twill be ripe.

The ear, when it *flowers*, will be upright; but a proper *shower* carries away the redness; and being pregnant with seed, it hangs *downward*, because longer: The grain is as above described; and by reason of its nakedness, it sometimes leaps out.

of HUSBANDRY and TRADE. 273

In *England* 'tis sown before the *Æquinox*, and the sooner the better.

It's esteemed the best bread-corn next *wheat*. The bread of it is more black and heavy, and of difficult concoction, especially if freed from the bran; and those that are not used to it, are sometimes grip'd and purg'd by it.

Some commend it before *wheaten bread*; because 'twill not dry so soon; and some mix it and *wheat*, that one may help the faults of the other.

C. Baubin has given the virtues of *rye* in physick, and thither I refer; but 'tis affirm'd, that *rye-meal* bound to the head with a cloth eases old head-aches; and mix'd with tops of *Wormwood*, 'tis good against madness; and the same meal dried and applyed to the part is very good against the *erysipelas*, or St. *Anthony's* fire.

Anno 1694, 1695, there was imported to *London* from several foreign parts 4715 quarters: And so much for *rye*. Next *Friday* expect more from

Yours,

JOHN HOUGHTON, F. R. S.

FRIDAY, *March* 19. 1697. NUM. CCXCVI.

Barley, *its description.* *Where it delights, and is sown. Rathe ripe barley. Patney-barley ripe in nine or ten weeks. All barley turns so at Patney, and returns in a few years in Oxfordshire. The conveniencies of it. Six ears on one stalk. When barley is ripe, and how manag'd in harvest time.*

Barley is a *graminious frumentacious* herb, whose seeds are of the greater sort, being covered with a husk growing in a *spike*, whose grains in the growth of them are bearded, their *husks* adhering close to 'em being the lowest.

Mr. *Worlidge* says, it so naturally delights in our meaner sort of land, and in the champion countries, that it's become a chief part of the country-man's tillage.

The seasons for sowing it differ according to the nature of the soil, and situation of the place: Some sow in *March*, some in *April*, and some in *May*, yet with good success; no rule can be prescribed; it usually proves as the succeeding weather happens, only a dry time is most kindly.

There is a *rathe-ripe barley*, usually ripe a fortnight or three weeks before the other, and delights best in some sorts of hot and dry land.

Of such a sort as this I printed an account in my quarto volume, which I had in a letter from Dr. *Rob. Plot*; and I find the account in the

twenty ninth paragraph of the sixth chapter of his natural hiltory of *Oxfordshire*. He calls it *hordeum distichum præcox*, or *rathe ripe barley*, it having been sometimes sown and return'd to the barn in two months time, and often in nine or ten weeks. 'Tis no native, but much sown in *Oxfordshire*, it being had mediately or immediately from *Patney* in *Wiltshire*; from whence 'tis called *Patney-barley*; where the soil, as he is told, is of so peculiar a quality, that whatever other barley is sown there, it turns into this; a feat, which, they say, no other land will perform. But Dr. *Childrey*, in his *Britannia Baconica*, says, that in the western parts of *Cornwall* they sow a sort of barley near the sea, which they carry to the mill in eight or nine weeks after 'tis sown. However, what comes to *Oxfordshire*, comes all from *Patney*, but is not so agreeable to the *Oxfordshire* soil immediately from thence, as when it has been sown elsewhere twice or thrice; after which, it endures not above three or four years, but degenerates again into common *barley*.

Its conveniency notwithstanding is very considerable in wet and backward *springs*, and moist *autumns*, when many other countries lose their seasons, and some of the more northern ones perhaps their *crop*, the common barley there never coming to be ripe, whereas this may be sown at the latter end of *May*, and will come to be ripe in the worst of summers. This was met with all over *Oxfordshire*, being generally approv'd of by all sorts of husbandmen.

The Doctor also tells us of six ears of *barley* from one stalk, found at *Fulbrook* near *Burford*.

In *Oxfordshire* they count their *barley* ripe (as they do their *wheat*) when it hangs the head, and the straw has lost its *verdure*, which they

276 *A COLLECTION for Improvement*

mow with a *fithe* without a *cradle*, never binding, but raking it together, cocking it with a *fork*, which is usually a *trident*, whose teeth stand not in a row, but meet pyramidically in a centre at the staff: They let it lie in the *swathe* a day or two, which both ripens the *corn*, and withers the *weeds*. Next *Friday* expect more from

Yours,

JOHN HOUGHTON, F.R.S.

FRIDAY, *April* 1. 1698. NUM. CCXCVII.

Barley like wheat. *Transmutation of corn.*
Advantage of barley. History of malt
epitomized.

DR. Plot, in his history of *Staffordshire*, tells us of a *zeopyrum*, *tritico-speltum*, or *hordeum nudum*, naked barley, which he found at *Brocton* and *Ellarton Grange*, where they call it *bare-barley*; he supposes, because without husk: And *wheat-barley*; because, tho' its ear be shaped like barley, its grain is like wheat without any husk. Wherefore the *Latines* have termed it *tritico-speltum*, it having the stalk, joints, and bearded ear of the true *zea* or *spelt* of *Lugdunensis*, tho' the corn be like wheat, and not husk'd as all *spelt* is. At *Rowley* 'tis call'd *French barley*; because like what is in the shops under that name. In short, 'tis a plant between wheat and barley in goodness as well as form; it giving a *flower*, as worse than wheat, so better than barley; and

of HUSBANDRY and TRADE. 277

'tis *sown* to be used instead of wheat (for bread) in a scarcity. It runs to *malt* as well as other barley, and makes a good sort of drink, and encreases in some soils twenty fold.

He also tells us of one sort of grain changing into another; and for it produces several authors, which I cannot gain-say; but being 'tis beyond my philosophy, I only refer my readers to those authors.

Barley is grown a very useful plant here in *England* both to *crown* and *people*; for of it is made malt, which pays four shillings the quarter, besides the excise on *beer*, *ale*, and *spirits*; all *which* make a very great branch of the revenue, and *without* doubt 'twill increase; for the advantage being so great, 'twill be the interest of the court to encrease its consumption, and one of the best ways to do that, will be to encrease the people; and that is so much our interest, 'tis worth giving a large tax for: Beside, if drink be dear, people will work harder, rather than go without it; and Sir *John Barley-corn* has more chearful and obedient servants, than any subject in *England* besides.

In my first quarto volume, Numb. 7. *June* 15. 1682, I gave the history of *malting* practis'd at *Derby*, describ'd by Mr. *J. F.* *which* I shall here epitomize.

Malt may be made of all sorts of grain; but is made at *Derby* of *sprat* or *battledore* barley; and the malster takes care it be *bold*, *dry*, *sweet*, of a fair colour, *thin skin*, *clean saltred from hains*, and dress'd from *foulness*, *seeds*, and *oats*, and not *beated in the mow*.

This barley in the cistern is covered with water from the brook, rather than spring, and there
it

it lies till the husk will rise or shell a little from it, *which* 'twill do after three or four nights; then the water is drawn off, and they let it lie six, eight, ten, or twelve hours to drein.

'Tis best to let it have rather too little, than too much water.

When well drein'd, 'tis *thrown* from six or eight inches thick to a heap on the couch floor, according to the weather; and 'tis stirr'd *with* the broad casting-shovel once, twice, or thrice, or more times in a day.

After couching some days 'twill sweat a little, and begin to *shew* the *chit* or *sprit* at the root-end; and in four or five days more 'twill become long; but except it *grow* very cold, it must be laid thinner, and stirr'd three or four times in a day; but differs greatly according to weather, and it must be minded accordingly, and seldom let the sprit run farther than half an inch.

Besides the sprit there is an *acrospire*, that *grows slowly* under the skin unseen, and the corn malts no farther than it runs through the husk, it carries the heart of the corn with it; wherefore I observe a good malster must take great pains, and have his wits about him, or he may soon be undone. Next *Friday* expect more from

Yours,

JOHN HOUGHTON, F. R. S.

FRI-

FRIDAY, April 8. 1697. NUM. CCXCVIII.

How malt is dried. A brisk kiln. How turn'd. How the kiln is made. Its advantages. Floors made with plaister. How malt is trod. Brick and stone kilns for malt in Staffordshire. Uses of malt. Beer and ale.

THE malt being made as in my last, 'tis laid on the kiln to dry something thicker than it lay on the withering floor, where, when it has lain some five hours with constant fire under it, the first turn is given it; about four hours after that the second, and three hours after that the third; and if the kiln dry well in three hours more with a moderate fire (for fear of *fire fanging*) 'twill be dried enough. The goodness of the kiln, and greenness of the malt, makes it sometimes more and sometimes less hours in drying: But they have a brick-kiln, which will dry more in four hours than usually was in twelve hours. There is great art in turning the malt on the kiln, which is shewn in the fore-cited place by cuts: But the common way (tho' not so good) is to lay on an heap in the middle, all the malt: And the hair-cloth being laid even, this heap is cast round, and the place where it lay left quite bare, lest any corns sticking shou'd be *fire-fanged*: Then the bare place is fill'd from the sides, and it being raked very even, 'tis left.

There is described the *brick-kiln* which I cannot epitomize, but refer you. This once heated,

ed, retains it a long while, which saves much fuel contrary to the other. In this *fire-fanging* (or burning the *comes* into a brown reddish colour, which will smell of fire, yield no quantity of liquor, and that with a high colour and ill relish) is never feared or known, for the bricks are heated alike, and the malt is dried very evenly. This kiln seldom wants repair, and that is done easily.

All the floors are made of plaister, which are much better than those of *mud, lime, or boards.*

The *malt* being dried, 'tis remov'd from the kiln, and laid above a foot thick, and trod round three or four times, beginning at the out-side, and winding to the middle of the heap, and so back. This is call'd a course; and in two or three such courses, if well dried, the malt will be trod enough; that is, all the *come* will be rubbed off; and if the malt be to be kept long, 'tis thrown on a heap in the dust; but if it be sold in two or three months, the dust is separated by running it through a *fan* or *frit*, that it may take the air better in the heap, and become more mellow. 'Tis best to grind malt ten or twelve days before 'tis brewed. One gentleman would have double that time, and the water five or six days in the vessels before he would use it; *but then he shou'd have thrown away the settlings.*

Dr. Plot, in his natural history of *Oxfordshire*, tells us of *malt-kilns* made there with long bricks, much like these in *Derbyshire*. He says they have also about *Burford* lately made their *malt-kilns* of stone, of which he has given a description in words and on a plate, This was invented by *Valentine Strong*; and with it they can dry three times

of HUSBANDRY and TRADE. 281

times the *malt* in the same time, and with the same fuel as they cou'd before once; and he supposes the *Cornish* warming-stone, or the *Spanish rugzola's* wou'd do better yet.

Barley prepared any way, Mr. Ray says, never heats the body. Formerly and lately in dear times it has been used for bread; but, I presume, only thro' scarcity of wheat.

It is good in many physical cases, but 'tis chiefly used to make beer and ale when malted.

For this liquor the *English* bear away the bell, and there is not a country where there is not good made: But some are more esteemed, as *Derby*, *Nottingham*, *Stockton*, *Hull*, *Sambich*, and *Margate*, with many more: And custom makes most think their own best; and all sorts are brought to *London*; and I think I have drank some (altho' not commonly) as good made in *London*, as ever I met with of other. The manner of making every one pretends to; but our *London* brewers have a knack that makes a great deal of their ordinary ale very pleasant.

Yours

JOHN HOUGHTON, F. R. S.

FRIDAY, April 16. 1698. NUM. CCXCIX.

How much beer and ale paid excise in nine years. A comparison between that and the people. A proposal and reason for it. Care for the laborious poor.

I N my last I hinted beer and ale. I wish I knew how much was brewed in a year in England;

England; but I'll give you the best account I can, and guess at the rest.

I have by me an account of all the beer and ale brewed in *England*, that paid custom from the 24th of *June* 1684, to the 24th of *June* 1693; and in all the nine years there were 62934158 barrels, which is 6992684 1 q. the year one with another. From whence I observe, that we spend a great deal more in times of peace than war; and that there was spent not 7000000 of barrels for the 8000000 of people I suppose in the land; that is not one barrel the head, and is nothing nigh a pint a piece for each man, woman, and child in *England* for a whole week, besides what they brew themselves.

I also observe from another account I have of the said nine years, that the country do not spend three times as much as *London*; yet *London* (suppose they mean the whole bills of mortality) is not the tenth part of the kingdom: Wherefore if the *excise* were to be universal, 'twou'd raise a great sum. For instance; suppose strong and small together was but twelve pence the barrel; and each drank but a little more than a quart a day, 'twou'd amount to 1200000 l. the year; but if two thirds shou'd be small at twelve pence, and one third strong at three shillings the barrel, 'twou'd amount to 2000000 the year; but whether this will be raised best thus, or by only a duty on malt; or, as 'tis now, part on malt and part on drink, I submit it to those concern'd; but if we must have great taxes, I think this as easy a way of raising it as most others, and after some time of use 'twou'd be quite as easy, except to lighten it, we would lay some upon *wheat*; and if we shou'd consume two bushels the head each year, and pay but one shilling the bushel
at

of HUSBANDRY and TRADE. 283

at the mill, it would amount to 800000*l.* the year, or upwards.

A little addition or subtraction *would answer* all our occasions, except they *were* very urgent, and then a small tax on land *would help*: For I think there shou'd be but little on trade, and that only *where* a plain reason can be *shewn*, that it shall be the means of promoting it.

I have formerly given my reasons why I would have a duty laid on necessary things; and 'tis because if necessaries to life be dearer, people will *work* harder; that will make more manufacture, *which will* for a *while* cause cheapness, and that will make it sell. I speak this in the general, knowing there are a great many particulars that sell the better for being dear.

I do not mean by this, that I would have any hardship put upon the honest laborious poor; but the generality of the poor are very lazy and expensive, especially the manufacturers, as may be seen in *London, Norwich, Manchester*, and several other places, not to excuse the labouring men, as the *tanners* in *Cornwall*, the *colliers* at *Newcastle*, and several other places, beside the idle *hedgers, ditchers, and thrashers* in all the towns that ever I came to; and if these could be made to *work* more, 'twould be no hard matter for the parishes to give a helping hand to those poor, that are really laborious.

Yours, &c.

JOHN HOUGHTON, F.R.S.

FRI-

FRIDAY, April 22. 1698. NUM. CCC.

At Ware in Hertfordshire have been 300000 quarters of malt at one time. How many barges, and what they carry on that river. Some brought by land, and why: Difference between land and water-carriage. objections against navigable rivers, and answers.

IN my last I spake about *excise* on *barley*, &c. now something on its *carriages*, which are very great by land in carts and waggons, even to the town of *Ware* in *Hertfordshire*, where, I have been assured, have been laid up at one time 300000 quarters; and upon that little river of *Lea*, that comes from thence into the *Thames*. Below *Blackwall* are twenty six barges, twenty four whereof come from *Ware*; and, as I have been inform'd, bring twelve score quarters each about two and fifty times in a year; for although sometimes they cannot make a voyage in a week, at other times they do more; and all these amount to (299520) two hundred ninety nine thousand, five hundred and twenty quarters, beside what is brought by cart to serve the north side of *London*: For altho' there is a great disproportion between land and water carriages, yet considering those about *Old-street* and *Shoreditch* (for instance) may have it brought by water to the wharf much cheaper; yet the landing and carrying home by carrs over the stones of *London*, and charges attending, besides the certainty of coming at set times

times (for in the river sometimes they want water, and sometimes have too much ice.) For these reasons, I say, these north-side folk think it worth their while to have a great deal brought by land from so short a cut as *Ware*; but I hear of none that comes from *Reading*, *Newberry*, *Abingdon*, or *Oxford*, or from the distant places in *Kent*, but by water; and I have been told, they will bring that for ten pence three hundred miles down the river *Thames*, which will cost three shillings to bring by cart from *Hitchin*, which is but thirty miles: Wherefore 'tis to be wish'd that we had more navigable rivers; and those were lengthned and improved that we have, which I hope I may live to see; because the parliament seem well disposed towards such things.

I know there are some objections against making rivers navigable; as 'twill decrease the use of horses, carts, and men; but the like objection may be made against printing, and all sorts of engines, yea, against horses, ploughs, and carts; for they hinder the employment of men, supposing a certain quantity was to be carried; but this will make things so dear, that the people will be able to sell almost nothing, and they must live poor and meanly, eating up their own product; for others will out-sell them; and if by births they should encrease, many would run away or be starv'd, because their product will not keep them, as 'tis in *Hudsons-Bay* and other places; when as by help of engines and other helps, as water-carriage, &c. they produce abundance, can sell all, and employ vast numbers more of people; and this do more and more, according to the easiness of the contrivances.

Another objection is, that 'twill bring up cheap corn, and spoil the price of what grows in the

up-lands. Have not the going down stream the advantage of going up; and if they keep their corn dearer, than those they must pass by, must they not bring it home again, and eat it themselves? 'Twill make them produce thrice the quantity; and if they sell abroad three bushels for three shillings the bushel, they shall grow richer than if they sell one bushel for six shillings.

Yours

JOHN HOUGHTON, *F. R. S.*

FRIDAY, *April 28.* 1698. NUM. CCCI.

More objections for making rivers navigable, and answers. The difference of land and water-carriage. Some proposals about rivers.

THERE are other objections against making rivers *navigable*, as that 'twill spoil the growing of willows by the river-side, the barge-men will steal the sheep and the poultry, and do a great many more such little things, which is a shame to name; but I know they were used against my Lord *Bullinbrook*, when he endeavoured to make the river navigable to *Bedford*.

Without doubt the bringing grocery and tobacco to these places cheap, will over-balance all these damages; and the like arguments may be brought against high-ways, for some inconveniencies attend them; and I think these people deserve no better answer.

But the main objection is, that it *will* take away mens land at over small values, and damnyfy some other places that have the trade *now*.

Seeing it is for a publick good, I cannot see why a very good recompence should not be given, but the land *owners* are also to consider that their land will be meliorated; for 'twill cause more building and popularity thereabout, and they may have the advantage of wharfs, fetching and carrying, beside dung, many other things; and who *grows* so rich as they that live nigh navigation? And if the pulling *down* of one *town* makes a better, *where* is the hurt? But perhaps it may put both to a greater industry, and that *will* be good for the whole; but supposing the contrary, if the greater good must not be done for fear of the lesser evil, farewell all *new* arts and fashions, and a *law* may be made to put a stop to all industry. I presume the parliament meet to consider *what's* best for *England*, not for any private place to the damage of the *whole*; if any such be, I *wish* some more publick spirited gentlemen may next time be chose in their room.

A curious gentleman in 1675, read a discourse to the Royal Society about water, *where*, agreeable to my present purpose, he says, the principal use of the sea and rivers, is for easie carriage of commodities; for a chalder of sea-coal is brought near three hundred miles for four shillings, which is in weight about thirty three hundred: But the land carriage of this by a waggon would be about fifteen pound, *viz.* seventy five times as much, and on horseback about one hundred times as much.

And for encouragement of making rivers navigable, he says, first, that a perch of river five foot deep, and about sixteen foot broad, may be

made at four pence the yard cube for less than twenty shillings, where the ground is good, free from rocks, &c. so that a mile of such excavation may be had for about three hundred pound.

Secondly, That in most cases 'twere better and cheaper to make *new channels* of just depths and breadths than even to bank the rivers already in being, and to repair all the inequalities of making use of the water of the old natural river, which is to be let into the new ones.

Thirdly, That these *new channels* need be no broader than that one boat may pass, which may be, if every quarter or half mile has a small dock for one boat to go into, whilst the other passes, if they should meet; or without docks, if certain times be appointed for ascending and descending. Next *Friday* expect more about this from

Yours

JOHN HOUGHTON, F. R. S.

FRIDAY, May 6. 1698. NUM. CCCII.

Farther accounts about navigable rivers. A proposal.

LAST week I gave three notes about *navigable rivers*. Fourthly, where the beginnings of rivers do lie higher one than another; or where several rivers do rise out of one great mountain in the several heights of it, there must be fitting contrivances to join them, other than the locks and sluices now in use, which are impracticable,

practicable, where the difference is above twenty foot, or thereabouts; I say, provisions may be made to comply with a difference of about one hundred foot.

Fifthly, In order to the performing of this work, such contrivances must be had, as to furnish any channel fit for the purpose, which, of it self, has no water at all, with sufficient water from elsewhere.

Sixthly, A necessary preparation to this work, is a map of the country, expressing not only the plain or level thereof, but also the inequalities and diversities of its surface, as to figure and matter, with the mean quantity of water which is in every river of such country, and with the mean quantity which passes through it in an hour, or any other assigned space or time.

Seventhly, To know whether making of rivers navigable would be a thing of profit, a computation must be made, which is most easy, of the annual charge of land-carriage to and from *London*, and between perhaps twenty other *emporia* of the kingdom, as also an estimate of the numbers travelling to and fro between those places.

Eighthly, There must be a law for purchasing all ground fit for this purpose at moderate rates, and for sending all malefactors (not deserving death) and all idle persons to this work.

Having premised these eight particulars to encourage this work, I shall bring one computation, which, without the other above-mentioned, is of it self sufficient to support the design; which computation consists of these following branches, *viz.*

First, That but one year in three is time of war.

290 *A COLLECTION for Improvement*

Secondly, That the intrinsic value of *Newcastle* coals is not above fifteen shillings *per* chaldron, under which rate within this forty years they have been bought and sold at *London*.

Thirdly, That in time of war (I suppose he means a *Dutch* war) they are at a medium, sold for forty five shillings a chaldron.

Fourthly, That about 300000 chaldron are yearly brought into the port of *London*.

From all which it follows that *London*, in the years of war, pays 450000*l.* extraordinary for its coals; that is, the one third part of the same at a *medium* in times of war and peace, which is 150000*l. per annum*. Now if the purchasing a perpetual convenience worth 150000*l. per annum* be worth as many years purchase as land, the value of this convenience at fifteen years purchase is 2250000*l.* Next week expect more.

Yours, &c.

JOHN HOUGHTON, F.R.S.

FRIDAY, May 13. 1698. NUM. CCCIII.

The charge of making rivers navigable, and the conveniency of 'em. Objections, and answers, and conclusion.

MY author farther says, it's certain that there are coals somewhere within 100 miles of *London*; and if a navigable channel could be made as in my last, between such places and
London,

of HUSBANDRY and TRADE. 291

London, after the rate of 300 *l.* the mile, then the purchase of this conveniency would cost but 30000 *l.* or if you please to comprehend all accidents, ten times as much, *viz.* 300000; yet such charge is not the seventh part of the 2250000 *l.* above mentioned.

My author says, that, to the best of his understanding, if 1000 miles of new navigable channels were made in fitting and passable places of *England*, the conveniency arising thence could not cost three years purchase, besides the employing and punishing all idle persons.

He says farther; if this were done, the ports of *England* would be fewer and better, and the kingdom more secure from invasion and interruption of trade, and also from the distractions and tumults which may happen amongst poor and mutinous people upon the want of commodities of necessary and daily use.

Without doubt navigable rivers will be of greater use to the countries through which they run, than any man whatsoever can at present suppose.

But some antagonists to my author say, 'tis better for *England* and *London* to fetch coals from *Newcastle*, than to have them at *Blackbeath*, which he thinks absurd, and inferrs, that 'twere better to fetch cinnamon from the *East-Indies* to heat our ovens, than to cut furze or faggots for the same.

This, with my author's leave, is a moot point. I'll shew some reasons on both sides.

'Tis vain to take much pains, where little will do. Printing and weaving by all persons are esteemed before writing and needle-work.

Engines and quick contrivances will be of no use.

To this is answered, that 'tis better to throw stones against the wind than be idle : And we have a great many idle persons already ; and if employments should cease, we should have more ; and a greater employment will encrease our people.

Where needs are very small, industry is very little, and wealth as little, and so the contrary.

Our law encourages fetching tobacco from *Virginia*, and prohibits its growing in our gardens ; and if cinnamon grew in our plantations, it might be worth while to fetch it for our ovens (especially for those bak'd meats we are not to sell abroad) for the overplus we should sell would bear our charge.

'Twas never known, that a great plenty of shipping ever made a place poor : Neither did building churches, monuments, or any magnificent structures.

Printing and weaving employ more now, than writing and needlework did : Therefore 'tis my opinion that all trades for exportation, or in order to it, that may be very much encreased by contrivances of cheapness, those contrivances ought to be encouraged ; for the rest, 'tis no great matter. And if we had always out a great fleet of men of war, and would to the utmost encourage finery, great buildings, fine shews, and making navigable rivers, 'twould employ our people, and consequently encrease our foreign as well as home consumption, which must make us seek a supply which certainly will enrich us. And thus much for the trade of barley and navigable rivers as useful for its *portation*.

Yours, &c.

JOHN HOUGHTON, *F. R. S.*
FRI-

FRIDAY, May 20. 1698. NUM. CCCIV.

Oats, their history.

IN my last I finished the history of *barley*, with some propofals about navigable rivers as useful to its portation. Now for *oats*, which Bishop *Wilkins* says, are seeds of the greater kind, being covered with a husk growing in a panicle, or disperfed tuft, at a distance from each other, upon long weak stems, not above two together, hanging down.

There are divers sorts of oats, but the chief are the white and black; and they grow in all countries, as well hot as cold; and are sowed in *England* and countries near, in the latter end of *February* or beginning of *March*, tho' I am told, that supposing the winter proves not excessively severe, 'tis best to sow black oats at the same time when they sow wheat; for black oats are much more hardy than white; and such as survive the winter, will bring great plenty of weighty oats.

Oats being a temperate sort of grain, they are much used with us, both in meat and medicine; but are chiefly sown for horses, geese, and other poultry.

Oats being husk'd and made into that we call oatmeal, are used by poor and rich to boil with meat, and make that broth we call *porridge*, and the poor throughout the kingdom seldom boil one without the other: 'Tis to us as *rice* is to the *Indians*, *sago* to the *Chinese*, and *vermicelli* to

to the inhabitants of the *Mediterranean* sea-coast. And 'tis the common food for the sick, if boil'd only in water, having a little salt butter and sugar added, and this is called *Water-gruel*, with the addition of rose-water and nutmeg, having a little other spice boiled in it first, 'tis eaten as a dainty, and of late plain water-gruel, with a little salt is commonly sold in our coffee-houses for a peny a dish; and some put chocolate to water-gruel, which thickens it and makes the less chocolate serve, and I am told 'tis very good.

The whole kernels of oats are called *grotes*, and with them milk, butter, spice, and peny-royal, are made oat-meal puddings; some put to them suet and raisins, and with the first things mingled with hog's blood, hog's and sheep's guts are stuff'd, and they are call'd black-puddings.

With the flower of oat-meal, water and yeast, or barme, are made oat-cakes, which are baked on a stone, and here at *London* are toasted, slit, butter'd and eat as rarities.

When women are delivered of children, or, as we say, lie in, the nurses feed them much with caudle, which is made with pounded oat-meal boil'd in water, and with seeds or spice, to which they add ale, and sometimes white-wine, and sweeten it with sugar; and this is generally a treat to any that make a visit.

In the mountainous parts of *Wales*, and north of *England*, most of the bread the ordinary people eat, are oat-cakes, made in divers forms, and they thrive well, and live long with them.

With malted oats is made a pale coloured small pleasant sort of ale, which pleases our gentry much, and is commonly at *London* sold for three pence the quart-bottle.

of HUSBANDRY and TRADE. 295

Tho' these things are common with us, yet they are proper to my history; and most part of the world knows little or nothing of them. In my next for *Flummery*.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, May 27. 1698. NUM. CCCV.

Flummery. Oats useful in Scotland. Oatmeal bread. Oats grow in most countries. Useful for most creatures. Best way to keep oats. Red oats. Naked oats. To keep oats from mustying.

IN my last I shewed a great many uses of oats, beside which we have learnt from the *Welch*, a sort of food called by them *Llummery*, by us *Flummery*, which is made with beaten oatmeal steep'd in water till 'tis four, which 'twill be in two or three days; then 'tis strained, and the straining boil'd to a jelly; which, when cold, is swallowed up in ale, milk, or wine and sugar, and is very pleasant food, and of good use, especially when four, in fevers.

Mr. *Ray* says a great deal more of it; besides, he gives the physical uses.

I have heard that the *Scots* use oats in a great degree in their wars; with a bag of oatmeal and a kettle they'll sustain themselves a great while; and indeed 'tis a fit corn for their country: For oats may be sown and mown while the

the sun is hot; when harder corn requires longer time.

I am told, that of late since corn has been very dear in several places about *London*, the poor have made their bread with three parts oat-meal, and one part barley. And this week I hear from a man of value in *Staffordshire*, that oats are the chief sustenance of the poor there, who are now in a starving condition.

Mr. *Worlidge* says, that oats will grow plentifully on such land where no other grain will thrive, by reason of the cold; and there is no ground too rich or too poor, too hot or too cold for 'em. He also says, that it is the best grain for horses, and to make poultry lay store of eggs: But, by his leave, I believe 'tis chiefly given them, because 'tis cheapest, and barley will make horses thrive well in *Spain*, and hens lay well here; if they give other corn, 'tis best to mix short straw or chaff with it: And Mr. *Gervaise Markham* says, he has known an Ox fed with oats, sold for thirty pound, and sheep and goats to great profit, likewise swine; but they must have some pease at last to harden their fat; and to keep them ordinarily in good flesh, he highly commends ground-oats, with whey or butter-milk; and in the time of their sickness some such mixed with raddle or red-okre. He also commends them for sick dogs and poultry, and truly almost for every live creature, thinking it as useful as salt.

He thinks the best way of keeping oats is to have 'em well dry'd, and kept in close casks; altho' some think it good to keep 'em thrash'd, and to lie in their chaff, which chaff will imbibe the moisture of the air before it comes to the oat.

Dr.

Dr. Plot tells us, that all over *Staffordshire* he found red oats, which was quite different from any oat cultivated in the south of *England*, the grain being redder, larger and fuller of flower, and requiring a stronger soil than others do, of which they make their best oaten bread in that county.

At *Buxton upon Trent* he was shewn a naked oat sown that year, which grows in all points like other oats, saving they are much smaller, without husk, and are indeed perfect grits, requiring no mill to make 'em into oatmeal, as other oats do.

Rich. Fermor of Tusmore, Esq; in *Oxfordshire*, to save room in his stable, had a contrivance to let oats down from a loft out of a vessel like the hopper of a mill, whence they fell into a square pipe, let into the wall about four inches diagonal, which comes into a cupboard set into a wall, but with its end so near the bottom, that there shall never be above a desirable quantity in the cupboard at a time, which being taken away, another parcel succeeds; by this motion the oats are kept constantly sweet (the taking away one gallon moving the whole above) which laid up otherwise in great quantities grow frequently musty.

Yours,

JOHN HOUGHTON, F. R. S.

 FRIDAY, *June 3.* 1698. NUM. CCCVI.

How many Oats imported Anno 1694. Rice, its description. Quantity imported. Its uses. Some Notes for increase of wealth.

TO compleat the history of *oats* I have only to tell you, that *anno* 1694. there were imported from *Holland* 2376 quarters, and from *Holstein* 500 quarters, in all 2876 quarters.

Another imported grain is *rice*, which is said to be a *graminious frumentacious herb*, whose seeds are of the greater sort, being covered with a husk growing in a spike, whose grains are more turgid and round than barley, growing at a greater distance, in a kind of compounded ear, which seems to consist of several lesser spikes.

Of this there was imported *anno* 1694, from *Spain* 120 hundred, from the *Streights* 1545 hundred, from *Holland* 330 quarters; in all, 1665 hundred, and 330 quarters.

Rice is the food of a great part of the world, particularly of *India*, where it grows in great plenty in watry places, without much culture.

It is of very good nourishment and pleasant, boil'd in milk or broth, or dressed several other ways, and very proper in most fluxes, and in consumptive and thin bodies.

The *Indians* and *Turks* live so much on it, that if they were to have twenty or thirty dishes at table, the foundation of all would be rice.

A ptisan of rice in *India* (as with *French* barley with us) is a vehicle for many of their medicines.

With

of HUSBANDRY and TRADE. 299

With it they make a strong spirit which they call *Arak*, and our seamen *rack*, with which, instead of brandy, they often make punch; and I do not doubt but in order to make their rack, they first malt it, and make it into ale; or otherwise 'twill be difficult to draw from it spirit.

'Tis a sort of grain will keep very well; therefore of excellent use in places besieged.

In the countries where rice grows, they commonly live very cheap; therefore at first sight one would think, the *working* cheap, they should outdo the rest of the world; but 'tis quite otherwise, for there they *want* for their necessaries but *few* people; and *where* 'tis so, there seldom is much *wealth*, for that goes along *with* a multitude; and *where* men can live for a little, to what purpose is it to take care for much? Without doubt the trade to *India*, considering the large extent, is not the tithe of what it is in *England* or *Holland*. Neither *would* the wealth be so much in the *Indian* courts or cities; but that they make necessities by using a great many very fine manufactures. 'Twas the saying of a wise man, that 'twas better to live *where* a capon would cost ten groats, than *where* it might be had for one; for there the people must use a great deal of industry to get the ten groats; and not only labour *with* their hands, but also study with their heads to find out engines and contrivances to ease their labour; and *with* these they gain an over-plus, and lay it up in store, thinking they never have enough to support in a time of need; and for this reason chiefly are estates laid up, and were our lazy poor, and those that live upon commons and woods sides, put to the necessity of either working or starving, they would soon take care to get something before-hand, and so live as comfortably

300 *A COLLECTION for Improvement*

fortably as the rest of their neighbours; whereas now the one sort say, that a cow and a few sheep on the common will find them food and raiment; and fuel they have for fetching, and they, with the rest, cry, if they come to extremity, the Parish is bound to find 'em; and to what purpose then should they take much care. Wou'd these things were as well consider'd by all men in authority in *England*, as they have been by

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, *June 10.* 1698. NUM. CCCVII.

Canes described. How many imported. For what uses proper. Cane-chairs preferr'd. Careening, what.

THE next imported matter to be considered, are *canes*; which are reckoned among the graminious plants not used by men for food, and are less properly grasses, and are considerable for the stalk, being of the greater kind, of a woody substance, porous, used for walking-staves.

Of these there were imported in *anno* 1694. from the *Streights* 17750, from *Germany* (were returned) 100, from *Holland* 1000, in all 18850, beside certain twice.

Of canes there are divers sorts, and some of them, Mr. Ray tells us, are of some use in physick, but 'tis where they are green; to us they come dry, and divers sorts of them are used as sticks

sticks to walk with; and some are so long and streight in one joint, and so finely marked, that a guinea has been the value of one; but with fine heads and ferrula's they have gone to very high prices. Some are so great as to make staves for gentlemens porters. When young, they are pickled for sauces.

There are also a sort of small ones that are divers yards long, and much about the same bigness in all parts; these they split and make chairs with, also lanthorns (or if you quarrel with that name, such things as they carry lighted candles in) and several other utensils, and they are grown to a very considerable trade, making chairs to be light and clean, when the former turkey-work'd ones were very much otherwise.

Beside these, there were imported from *Portugal* 11000 *reed-canes*. These are greatly spent at this time of the year, to tie cherries to, which are sold about the streets at a penny and half-penny the stick; but a great use they are put to, are for *slaves* for weavers; also they are used by wine-coopers, and for angle-rods; with them abroad they make cages for parrots, and what not.

In *Gresham-College* there is part of a sort of *Mambu*, a great *Indian* cane in *Baubinus's Pinax*, called *Arundo Arbor*, described by *Wormius*. But whereas his was black, this is of a straw-colour, and much smaller, *sc.* about seven inches in compass. Some of them grow nine or ten yards high. 'Tis hollow quite through, excepting that at every joint 'tis closed up with a tranverse plate or floor, necessary for the adding strength and sturdiness proportionable to so great a height.

It grows in *Malabar*, especially about *Coromandel*, near the sea-side. In the several hollows

302 *A COLLECTION for Improvement*

is found a curdled juice, whereof the natives make a sort of sugar, by the *Æthiopians* called *Tabaxy*, much valued by the *Arabians*, because of the medicinal virtue they at least suppose it to have. In *Bantam* the cane is much used for the building of their houses. Thus *Dr. Grew*.

We have a sort of cane growing here in *England*, especially by the side of the river *Thames*, which we call *reeds*; these grow to the height of six or eight foot, and when cut down, well dried, and made into bundles, they are used for the careening of ships; that is, laid one side on the shoar; and on the other side with bundles set on fire they heat her, that the pitch and careening stuff may, by being warm, be rubb'd to and fro equally, and thereby have all the hollows filled up.

Yours &c.

JOHN HOUGHTON, *F.R.S.*

FRIDAY, June 17. 1698. NUM. CCCVIII.

130700 canes imported. Sugar-cane, its description. What makes sugar kern. How 'tis refined, and sugar-candy made. The sugar of the ancients not the same with ours.

IN my last to the 18850 imported canes should have been added from *Spain* 68000, *Portugal* 22500, and *India* 21350, in all, 130700.

In the next place comes the sugar-cane. *Arun-do Saccharina*. In *Brasil* *Dr. Grew* says, called *Tacomaxée*;

Tacomaxée; to which place it was transplanted from the fortunate Islands. A great *reed* about seven or eight feet high, with many joints, one at about every half foot, and a large close *pith*; out of which the greatest part of the juice, whereof the sugar is made, is expressed. *Piso* in the fourth book of his history, and *Ligon* in his history of *Barbadoes*, page 86, &c. has described this at large, together with the way of planting, gathering and pressing the same; and of ordering the expressed juice, for the making of several sorts of sugar and brandy; as also the engines, and contrivance of vessels for the same purposes.

The principal knack, without which all their labour were in vain, is in making the juice, when sufficiently boil'd, to kern or granulate. Which is done by adding to it a small proportion of lee made with (vegetable) *ashes*; without which, it would never come to any thing by boiling, but a syrup or an extract. But a little of that *fixed salt*, serves, it seems, to *shackle* or *chrySTALLIZE* (which is a degree of fixation) a very great quantity of the essential *salt* of this plant.

In refining the sugar, the first degree of pureness is effected only by permitting the *molosses* to drain away through a hole at the bottom of the *sugar-pots*; the pots being all the time open at the top. The second degree is procured by covering the *pots* at the top with clay.

The reason whereof is, for that the air is hereby kept out from the *sugar*, which in the open pots it hardens before it has full time to refine by separation. And therefore, whereas the first way requires but one month, this requires four. The finest sugar of all is made with *lime-water* (and sometimes urine) and *whites* of eggs.

304 *A COLLECTION for Improvement*

Sugar-candy (*saccharum cantum*), because it shoots into an angular figure,) by placing a great many slender sticks a-cross a vessel of liquid sugar for it to shoot upon.

That which *Dioscorides* calls *Ζάχχαρον*; *Galen*, *sacchar*, and *Archigenes*, *sal indum*; is the same thing for substance, saith *Matthiolus*, with that we call *sugar*; saving that whereas this is made of the juice expressed and boil'd; that of the ancients, as is likely, was only the tears; which bursting out of the cane, as the *gums* or *milks* of *plants* are used to do, were thereupon hardened into a pure *white sugar*. That the sugar of the ancients was the simple corrected juice of a *cane*, he well conjectures; and what is said in my last of the *mambu*, may argue as much. But that it was the juice or tears of the sugar-cane, he proves not. Nor, I think, could be, if, as is supposed, it was, like salt, friable, and hard. And in affirming our sugar to be the same for substance with that of the ancients, he much mistakes; that being the simple juice of the cane, this a compounded thing, always mixed either with the *salt* of *lime*, or of *ashes*; sometimes of animals too.

Yours,

JOHN HOUGHTON, *F. R. S.*

FRIDAY, June 24. 1698. NUM. CCCIX.

History of sugar in Barbadoes, 'when first planted there, how they improv'd. The particulars to be treated on.

ALtho' in my last I gave you what Mr. *Ligon* says of sugar in general; yet I believe 'twill be acceptable to have its history more particularly.

He landed on *Bardadoes* in the beginning of *September* 1647, where he found the great work of sugar-making but newly practised by the inhabitants, some of the more industrious having gotten plants from *Fernambuck* in *Brasil*, and finding 'em to grow, they planted more and more, till it was worth while to set up a very small *ingenio*, and so to make tryal what sugar could be made on that soil; but, for want of skill the sugars were very inconsiderable and little worth for two or three years; but finding their error by practice began a little to mend, and by new directions from *Brasil*, for which sometimes they made a voyage thither, returning with more plants and better knowledge, they went on upon fresh hopes, but still short of what they should have been more skilful in: For at his arrival they were ignorant in three main points, *viz.* the manner of planting, the time of gathering, and the right placing of their coppers in their furnaces; as also the true way of covering their rollers with plates or bars of iron. All which rightly done, advance much the main work. At his arrival he found

many sugar-works at work; but the sugars but bare *muscavadoes*, and few merchantable, so moist and full of molasses, and so ill cured, as they were hardly worth bringing to *England*. But about 1650. they were much better'd; they had the skill to know when the canes were ripe, viz. at fifteen months old, and before they gather'd them at twelve, to their great disadvantage; for the liquor wanting its due sweetness, caused the sugars to be lean, and unfit to keep. Besides, they were greater proficient in boiling and curing; and had learnt the knowledge of making them white, such as in *England* they called lump-sugars; but not so excellent as those they make in *Brazil*. Nor, as he thought, were they ever likely to make such, the land there being better, and lying in a continent, he thought it must needs have constanter and steadier weather, and the air much drier and purer than it can be in so small an Island as *Barbadoes*. And then it had gotten the start of all the other commodities in the island; and he then thought the sugar trade would admit of no farther improvement.

In five or six years, viz. from 1641 or 1642, when the sugar-trade first began in *Barbadoes*, till 1647, the trade so improved, that at first major *Hilliard's* plantation of 500 acres might have been purchased for 400*l.* but in 1647, the half was sold for 7000*l.* sterling. And 'tis evident that all the land there which has been employ'd in that work, hath found the like improvement; and he believ'd, that when the small plantations shou'd be bought up, and thereby plantations shou'd be made of five, six, or seven hundred acres to be worth minding: That two thirds of the island wou'd be fit for plantations of sugar,
and

and so 'twou'd be one of the richest spots under the sun.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, July 1. 1698. NUM. CCCX.

The particulars to be discoursed on. Where to set the ingenio, and why. How they formerly planted sugar.

IN order to the farther history of sugar, he thinks fit to tell us the nature of the plant, the right way of planting it, the manner of growth, the time of growing to ripeness, the manner of cutting, bringing home, the place where to lay them being brought home, the time they may lie there without spoiling, the manner of grinding or squeezing them, the conveyance of the liquor to the cisterns, how long it may stay here without harm, the manner of boiling and skimming, with the conveyance of the skimmings into the cisterns in the still-house, the manner of distilling it, which makes the strongest spirits that men can drink, with the temper to be put in, what the temper is, the time of cooling the sugar before it be put into the pots, the time it stays in the curing-house before it be good *muscavado* sugar, and the making it into whites which they call lump-sugar.

The place to be chosen to set the sugar-work or *ingenio* on, must be the *brow* of a small hill, that

that hath *within* the compass of eighty foot, twelve foot descent, *viz.* from the grinding place to the boiling house four foot and a half, and some little descent to the still-house. The reason of these descents are, the top of the cistern, *into which* the first liquor runs, is, and must be, *somewhat* lower than the pipe that conveys it, and that is a little under-ground. Then the liquor *which* runs from that cistern is two foot and a half deep; and so running upon a little descent, to the clarifying copper, *which* is a foot and half above the floor of the boiling-house (and so is the *whole frame*, where all the coppers stand :) it must of necessity fall out that the floor of the boiling-house must be below the floor of the mill-house four foot and a half. Then admit the largest copper be a foot and half deep, the bottom of the copper will be *lower* than the floor of the boiling-house by a foot; the bottom of the furnaces must be three foot *below* the coppers, and the ash-holes under the furnaces, are three foot *below* the bottom of the furnaces. A little more *fall* is required to the still-house, and so the account is made up. Upon *what* place the sugar work and *ingenio* are to be set, he has describ'd by draughts.

When Mr. *Ligon* first arriv'd upon *Barbadoes*, he observ'd their manner of planting and husbandry, especially of this plant, as being of greatest value and esteem, and he found it a strong and lusty *plant*, and so vigorous as to forbid all weeds to *grow* very near it; so thirstily it suck'd the earth for nourishment, to maintain its *own health* and *gallantry*.

But tho' the *planters* knew this, they did not rightly pursue their *own knowledge*: For they dug small holes at three foot distance, and put the
plants

of HUSBANDRY and TRADE. 309

plants end wise, with a little stooping, so that each brought not above three or four sprouts, and they being all fastened to one root, *when* they *grew* large, tall, and heavy, and storms of wind and rain came (and those rains fall with much violence and weight) the roots *were* loosned, and the canes lodged, and so became rotten, and unfit for making good sugar. And beside, the roots being far asunder, weeds *grew between*; and *worse* than all weeds, withs, *which* are of a stronger *growth* than the canes, and do much mischief; for they *wind* about them, and pull them to the ground. But experience taught that this way was most pernicious, therefore they tryed another, which he thinks the best, and you shall have the account of next week.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, July 8. 1698. NUM. CCCXI.

The manner of planting sugar-canes, and weeding them. A supply to defects. A way to kill rats.

THE best way of making *sugar-canes* (which I promised in my last) my author thinks is by *digging* a small trench of six inches broad, and as much deep in a *streight line*, the whole *length* of the land you mean to plant; *laying* the earth on one side of the trench as you make it; then lay two canes *along* the bottom of the trench

one by another, the *length* of the trench, and cover them with the earth you laid by; and at *two* foot distance, another of the same, and so a third, and a fourth, till you have finish'd all the land you intend to plant at that time: For you must not plant too much at once, but have it to grow ripe, that your work may come in order to keep you still doing; for if it should be ripe all together, you are not able to work it so; and then for want of cutting they would rot.

By planting thus *along two together*, every knot will have a sprout, and so a particular root, and be the more firmly fixt in the ground, and the better able to endure wind and weather; and by their thick *growing* be the *stronger* to support one another. When they have been in the ground a month, they will appear like a land of green wheat in *England*, that is high enough to hide a hare; and in a months growth, the careful and best husbands search to destroy what weeds have taken, or if any of the plants fail, supply them: For where plants are wanting, weeds will grow, the ground is so good. Or if any withs *grow* in those vacancies, they will spread far and do much harm by *pulling* down all the canes they can reach. This husbandry must be used when the canes are young, else the blades will become *rough* and sharp in the sides, and so cut the naked *negroes* as the blood will follow, which they will not endure. Beside, if these vacancies be not repaired with new plants in due time, they will never be ripe together, which will harm the whole field, for which there is but one remedy (almost as bad as the disease) *viz.* by *burning* the whole field, by which they lose all the time they have *grown*, but from the roots continuing secure from the fire, there arises a new *spring* all together; so that

of HUSBANDRY and TRADE. 311

that to repair this loss of time, they have only this recompence, *viz.* to burn an army of rats which do infinite harm in the island by knawing the canes, which presently after will rot, and become unserviceable in the work of *sugar*. To destroy these enemies securely, they begin their *fire* at the outsides of that land of canes they mean to burn, and so drive them to the middle, where at last the fire burns them all, and this great execution they put often in practice *against* these great enemies of their canes in the fields, of their corn and other provisions in their stores and victuals in their *dwelling-houses*. For when the great downfal of rains come, which is in *November* and *December*, and in the time of the *Tornado*, these rats leave the field, and shelter themselves in the *dwelling-houses*, where they do much mischief. Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, July 15. 1698. NUM. CCCXII.

The sugar-cane described: Part of them are food for cattle. How carried home, and where laid. How long the canes will keep good after cut down. How they are pressed.

THE *sugar-canes* with their tops or blades do commonly grow to be eight foot high; the canes themselves are commonly five or six foot

foot high; (but my author has seen some double that length) the bodies of them about an inch diameter, the knots above five or six inches distant; often but three or four; for there is no certain rule; the colour of the blades and tops pure *grass-green*; but the canes themselves, when they are ripe, are of a deep *popinjay*; and then they yield the greater quantity, and fuller and sweeter juice. They cut them with little hand-bills about six inches from the ground, at which time they divide the tops from the canes with the same bills at one stroak; and then holding the canes by the upper end, they strip off all the blades that grow by the sides, which tops and blades are bound up in faggots, and carried home in carts, to be eaten by horses and other cattle; for without these they are not able to work, the other pasture being so extream harsh and sapless, but these nourish well.

They commonly bind the canes at the same time up in faggots, and carry them home on *Affinigoes*, in which they use the fashion of *Devonshire* (from whence they learn'd it) *viz.* with small pack-saddles and crooks, laying on each crook a faggot, and one on the top: Use teaches the *Affinigoes* to carry each his three faggots from the field, to the place of unloading, and back without a guide.

They unload in a little plat of ground contiguous to the mill-house called a *barbycu*, about thirty foot long, and ten foot broad, done about with a double rail to keep the canes from falling out of that room; where one, two, or more (who have work in the mill-house) when they see the *affinigoes* come and make a stop, are ready to unload them, and turning back *again*, they go immediately to take fresh loading.

Being

of HUSBANDRY and TRADE. 313

Being laid on the *barbycu*, they are work'd out clean ; for if they shou'd be more than two days old, the juice will grow sour and not fit to work ; for 'twill infect the rest. The longest time from cutting to grinding, is from *Saturday evening* to *Monday morning* at one or two a clock.

The horses and cattle *being* put to their tackle, in order to grind them, they *go* about, and by their force turn (by the sweeps) and middle roller ; which *being cogg'd* to the other two at both ends, turn them about, and they are three, turning upon their centres, which are of brass and steel, *going* so easy of themselves, as a man holding one sweep, will turn all the rollers with ease. But when the canes are put between the rollers, it's a good draught for five oxen or horses : A negro puts in the canes on one side, and the rollers draw them to the other, where another *negro* receives them, and returns them through the middle roller, which draws the other way. They think this pressing enough, altho' the *Spaniards*, by pressing a third time, get out some more, which we think not worth our trouble. *Negro girls* carry the press'd canes about 120 paces, and there lay them on a heap. Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRI-

FRIDAY, July 22. 1698. NUM. CCCXIII.

A continuation of the history of sugar. The liquor will sour in one day, and it must sour before it be distill'd. How it boils and kerns. Oils used. How long the work holds without ceasing. In what cool'd, and how the goodness is tryed.

UNDER the rollers there is a receiver as big as a large trey, into which the *sugar-liquor* falls; from whence it runs through a lead pipe into the cistern fix'd near the stairs, as one goes from the mill-house to the boiling-house, where it must not remain above one day, lest it sour; from thence it passes through a gutter (fix'd to the wall) to the clarifying copper, as there is occasion to use it, and as it clarifies in the two first coppers, and the skim rises, it's conveyed away by a gutter, and both the skimmings are not esteemed worth the labour of distilling, because they are dirty and gross. But the skimmings of the other three coppers are conveyed to the still-house to remain in the cisterns till it be a little sour; for till then it will not come over the helm.

This liquor is remov'd (as it is refin'd) from one copper to another, and the more it passes through, the finer and purer it is, being continually drawn up, and keel'd by ladles, and skimm'd, till at last it comes to the *tach*, where it must have much labour in keeling and stirring; and

as

of HUSBANDRY and TRADE. 315

as it boils, there is thrown into the four last coppers a liquor made of water and ashes (I presume what we call *lee*) and they call *temper*, without which the sugar wou'd continue a clammy substance and never *kerne*: They put in but little, which makes the clamminess of the sugar to cruddle and separate; which by taking out some drops may be seen to candy, and suddenly grow hard; and then it has enough of the fire. Upon this essay they presently pour two spoonfuls of sallet-oil into the *tach*, on which, immediately it ceases to bubble or rise. So after much keeling, they take it out of the *tach* by the ladles they use there, and put it into bigger with two handles, and by them into the cooling cistern near the stairs that go to the fire-room. But as they remove the last part of the liquor out of the *tach*, they do it with all the celerity they can, and suddenly cast in cold water, to cool the copper from burning; for the fire in the furnace continues still in the same heat, and when that water is removed by the ladles, they are in the same degree careful and quick, as soon as the last ladle-full is taken out, to throw in some of the liquor of the next copper, to keep the *tach* from burning, and so fill it from the second, and that from the third, and that from the fourth, and that from the clarifying copper, and that from the cistern, and that from the mill-house or *ingenio*.

Thus the work goes on from *Monday* morning at one of the clock, till *Saturday* night (when the fire in the furnaces are put out) all hours of the day and night, with fresh supplies of men, horses, and cattle.

The liquor being cool enough to put into the pots, they are brought near the cooler, and stopping

ping first the sharp end or bottom of the pot with plantane leaves, the hole whereof is no bigger than a man's finger will go in at, they fill the pot and set it between the *stantions* in the filling room, where it stays till it be thorough cold, which will be in two days and two nights; and then if the sugar be good, 'twill sound like a whole earthen pot with a knock with the knuckle of a finger; but if the sugar be very bad, it will neither be very hard, nor give any sound. A farther account expect next *Friday* from

Yours

JOHN HOUGHTON, *F. R. S.*

FRIDAY, July 29. 1698. NUM. CCCXIV.

Peneles how made. How long muscavado sugar is in curing. An invention. What are ill canes. How sugar is taken from the pots, and sent to the bridge-town. The best and worst muscavado.

AFTER *sugar* is managed, as in my last, it is removed into the curing-house, and set between *stantions* there; but first the stopples are to be pull'd out of the bottom of the pots, that the *molloffes* may vent at the hole, by dropping down upon a board hollow'd in the middle, which conveyeth it from one to another, till it come into the cisterns, of which there are commonly four, at each corner one; and there it remains till it rise to a good quantity,

tity, and then 'tis boil'd again, and of that they make *peneles*, a kind of sugar somewhat inferior to the *muscarado*; but yet will sweeten indifferently well, and some of it is very well coloured.

The pots being thus opened, the *molosses* drop out, but so slowly, as hardly to vent it self in a month; in which time the sugar ought to be well cured; and therefore they thought fit to thrust a spike of wood in at the bottom, that should reach to the top, hoping by that means to make way for the *molosses* to have the quicker passage; but they found little amendment in the purging, because the spike, as it went in, press'd the sugar so hard, as it stopt all passage for the *molosses*. So failing in this, they devised an augure of *iron*, which cuts its way without pressing the sugar; and so the *molosses* had a free passage, and the sugar was well cured in a month.

Thus you have the whole process of making *muscarado* sugar, which is better or worse, as the canes are.

My author calls those ill canes, which are gathered before or after the time of ripeness, or are eaten by rats, and so consequently rotten, or pull'd down by withs, or lodg'd by foul weather; either of which will serve to spoil such sugar as is made of them.

At the time they expect it should be well cured, they take the pots from the stantions in the curing-house, and bring them to the knocking room; and turning them upside down, they knock the pot hard against the ground, and the sugar comes out as a bullet out of a mould; and when out, you may perceive three sorts of colours, the tops somewhat brownish, and of a
 Vol. II. Y frothy

frothy light substance; the bottom of a much darker colour, but heavy, gross, moist, and full of *molosses*; both which they cut away, and reserve to be boil'd again, with the *molosses* for *penes*: The middle part, which is more than two thirds of the whole pot, and looks of a bright colour, dry and sweet, they lay by its self, and send it down daily upon the backs of *assinigoes* and *camels*, in leather bags with a tarr'd cloth over, to their store-houses at the bridge, there to be put in casks and chests to be ship'd away for *England*, or the best market.

Though this care be taken by the best husbands, yet the greater number, when they knock out their sugars, let all go together, both bottom and top, and let the better bear out the worse; but they will sell but for little more than half the other: But those that take the most care, have such credit with the buyers, that they seldom open a cask to make a tryal, so well they are assured of the goodness of the sugars. Next week expect something of white sugars from

Yours,

JOHN HOUGHTON, F. R. S.

FRI-

FRIDAY, August 5. 1698. NUM. CCCXV.

White sugar, how made, to prevent mischief. Distilling of the skimmings. Strong spirits must be taken care of. A sad accident. How to prevent the like. The use of spirits.

NOW for *white sugar*, which requires four months time after boiling, though the *muscavado* may be done in a month. The way is thus :

Take clay, and temper it with water to the thickness of *frumenty* or *pease-pottage*, and pour it on the top of the *muscavado* sugar, as it stands in the pot in the curing-house, and there let it remain four months ; and if the clay crack and open that the air come in, close it up with some of the same, either with your hand or a small trowel. When you knock open these pots, you shall find a difference both in the colour and goodness of the top and bottom, being but to such a degree, as may be rank'd with *muscavadoes* ; but the middle perfect, white, and excellent lump-sugar.

Sometimes after great rains (which much moistens the air) sugar must be laid out on fair days in the sun upon cloaths, or in the knocking-room, and sometimes must be brought in pans of coals well kindled into the curing-house.

As for distilling the skimmings, which run down to the still-house from the three lesser coppers, it is only this. After it has remained in the cisterns, till it be a little four (for till then

the spirits will not rise in the still) the first spirit that comes off is a small liquor which we call *low-wines*. This liquor we put into the still, and draw it off again; and of that comes so strong a spirit, as a candle being brought to a near distance to the bung of a hoghead or butt, where it is kept, the spirits will fly to it, and set all on fire.

Thus by holding a candle near the funnel while the spirit was pouring into the butt, an excellent negro was burnt, and the whole butt of spirits lost; both which might have been saved: For if the negro had clap'd his hand, or any thing else on the bung, it would have stifled the fire presently; but he knew not this: However, a strict command was given to bring no more spirits into the drink-room by night, nor fire or candle at any time.

This drink, tho' it has kill'd one negro, it has cured many. For when, by lying on the boards naked all night (as they do) they take cold, and are ill, or any such like, the doctor gives them one cup of this spirit, which presently cures them; and to all sorts, as well whites as blacks. After hard labour, and wearisomness, 'tis a good restorative.

This drink is also a good commodity in the plantations; and besides what is drank by those that make it not themselves, a great deal is transported: For in a good plantation, as long as they keep working, they make to the value of 30*l.* sterling each week, besides what is drunk by their servants and slaves.

Yours, &c.

JOHN HOUGHTON, *F. R. S.*
FRI-

FRIDAY, *August* 12. 1698. NUM. CCCXVI.

The bigness of Barbadoes. How much sugar an acre will bear. What the Island is supposed to produce. Barbadoes the cultivated spot in the World. Examples of great wealth.

IN my last I shewed how they made the *strong spirit* from sugar. My author goes on calculating the great wealth that this *sugar plant* might bring to *Barbadoes*, which, as he says, contains 392 square miles, out of which, for other occasions, he subtracts one third of the worst of the land, and then remains 167680 acres; from which he abstracts for little plantations 30000 acres, and then there remains 137680 acres for sugar-works; out of which he allows but two thirds for sugar-canes, and three thirds for wood, pasture and provisions for the support of the plantations. Now these two fifths are 55072 acres, and an acre of good canes will yield 4000 pound weight of sugar, and none less than 2000 pounds; but he reckons the *medium* 3000 l. which at 3 d. the pound comes to 37 l. 10 s. the acre, which numbered by 55072 acres, allotted for sugar-plantations, upon which the canes must grow, and it will amount to 2065200 l. sterling in sixteen months. Now add four months for making it into whites, which in *England* they call *lump-sugar*, and then the price will be doubled to 4130400 l. but abating a quarter for

waste, tops and bottoms of the pots (tho' that will be good *muscarvadoes*) there still remains 3097800*l.* which is the total of the revenue of sugars that grow on the *Barbadoes* for twenty months, and accounted there upon the island at the bridge. But if the hazard of the sea be run, it will sell at *London* for double, and then 'twill amount to 6195600*l.*

This calculation makes a great deal of money from a little spot of ground, and the price of sugar is much altered since the time this calculation was made, *viz. anno 1650.* But if it amounts but to half this 'tis a great deal. I have been informed that 'tis the best cultivated spot of ground in the world; and that there has been freighted from thence in one year 201 fail of ships.

My author having given this candid and fair history of *Barbadoes* sugar (which I have epitomized as well as making it plain and intelligible will give me leave) he goes on to the praise of it, for fruits and our healths, with the cure of several diseases, quoting the old *Dr. Butler*, who says,

*If sugar can preserve both pears and plums;
Why can it not as well preserve our lungs?*

But of the physical uses I design not to treat at this time, but leave others to think as they please.

To end his history, he tells that colonel *James Drax*, whose first stock exceeded not 300*l.* sterling, had raised himself so high, as to hope in a few years to purchase an estate of 10000*l.* land yearly, and all by this plant of sugar. And no less bounded colonel *Tho. Modiford's* expectations than 100000*l.* sterling; but what they did get, I know not, altho' I have heard of them both
to

to be very considerable men. And thus much for Mr. *Ligon's* history for sugar.

Yours,

JOHN HOUGHTON, F. R. S.

FRIDAY, *August* 19. 1698. NUM. CCCXVII.

How much sugar &c. was imported in a Year, with notes on it. A proposal.

IN my last I ended Mr. *Ligon's* history of *sugar*, and how it was managed from first to last, in the year 1650; since which, without doubt 'tis improv'd to a great degree. I shall now give you an account how much was imported to *London*, according to the custom-house bills, from *Christmas* 1694, to *Christmas* 1695.

There was imported from *Portugal* of white sugar, C. 6. L. 28. baskets 25. boxes 4. fitch 4. chests 6. cask 1. and certain. From *America*, C. 122. loaf 1. C. 3. L. 28. From the *Canaries* of loaf, L. 50. In all C. 128. baskets 24. boxes 4. fitch 4. chests 6. cask 1. L. 28. and certain, beside of loaf 1. C. 3. and L. 78.

Of brown there was imported from *America*, cask 20313. C. 3564. Hogheads 11.

Beside this, there were imported of *succads* from *Portugal*, L. 3798. From *Spain*, L. 17176. From the *Streights*, L. 315. From *Holland*, L. 100. From *America*, L. 316; and from the *Canaries*, L. 342. In all, L. 22047. Of confects there were imported from *Portugal*, C. 24. Of *Molasses*

324 *A COLLECTION for Improvement*

losses from *America*, C. 6812. From *England* (I suppose) prize, C. 700. and *Guernsey* and *Jersey*, C. 104. In all, C. 7616. and of rum from *America* gall. 491. *England* (as prize) gall. 6. In all gall. 497. In all I suppose it to amount to about sixteen millions of pounds weight; and if there be eight millions of heads in the nation, it would be but two pounds of sugar, &c. to each head. Indeed this was a time of war, and so there might be brought but little, although (to the best of my remembrance) in King *Charles* the second's time, when peace, there was brought in one year about eight millions of pounds of sugar alone; and there was about two thirds of it exported: But then there went vast quantities to *Holland*, &c. from the out-ports, that were only unladed to pay the duty, and ship'd again presently; when as in time of war I suppose most came to *London*, that from thence it might have convoy.

I wish our plantations may so thrive as to produce twice as many goods as they do; but it is a question with me whether it would prejudice them to have *Lisbon* sugars brought into *England* upon the same duties as from the plantations: For if it be not brought hither, it will be carried to other markets, and there hinder the sale of ours: If it be brought hither in our ships, and we export it again, we shall get a great deal of money by it. If we should consume it ourselves, and our consumption be no bigger than before; then we must export our own in lieu of that: But if by using that, our consumption shou'd be so much encreased, then our plantations would have no reason to complain, because their consumption would not be lessened. Or if any body would shew me what would be the inconveniency, they would oblige; but however,

ever, I only put this down as a thing to be considered on, and am

Yours,

JOHN HOUGHTON, F.R.S.

FRIDAY, August 26. 1698. NUM. CCCXVIII.

*Conserves, preserves, and candies, what?
The charge of divers things.*

WHAT remains about sugar is, that *conserves* are herbs or flowers beat or boil'd up with sugar; *preserves* are boiled and kept in syrups; *candies* are boiled up to a higher degree.

There's a book called *the groans of the plantations*, which tells us, that the certain charges of a *sugar-work* are very great, and the casualties many.

The hanging of a *copper* or *still* costs one way or other three pounds; besides, they are perpetually burning out and spoiling; but a new one costs a great deal.

They must have yearly some hundred pair of *sugar-pots* and *jars*. Every hundred pair costs near ten pounds; and they fetch them several miles upon negroes heads.

The wear of their *mills* is a continual charge, and a new-built mill (if perfect) costs near 500*l*.

The freight of every *servant* from *England* is five pounds, and their cloths and other necessities little less. Their time may not be above five years, and is commonly but four.

They must have a great many *horses*; and in *Barbadoes* they scarce breed any. The freight of

a horse from *England*, with his hay and water, is ten pounds, besides a great hazard of losing him by the way.

He that hath but one hundred *negroes*, should buy eight or ten every year to keep up his stock: And they will cost about twenty pounds each head.

A good *overseer* will have a hundred pounds the year. Some give a great deal more. There are others also that must have great salaries, and they cannot be without them.

The remassing the vast quantities of *dung* they must use, the carrying it to the field, and disposing it there, is a mighty labour, which in effect is charge. An acre of ground well dressed, will take thirty load of dung; and he that has two windmills must plant yearly near one hundred acres.

They carry mold and cane-trash, or any thing that is proper, into cattle-pens, and into their still-ponds, to turn all into dung. They take all ways and means for the raising of dung; they scrape it out of every corner. Some save the urine of their whites and blacks to encrease and enrich their dung.

They make high and strong walls or wears to stop the mould that washes from their grounds, which they carry back in carts, or upon *negroes* heads: For the *negroes* work like ants or bees.

I can't give you all till next week, but am

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, Septemb. 2. 1698. NUM. CCCXIX.

*The militia of Barbadoes. Their casualties.
Those places thrive best that want the
most people.*

BESIDE the charges about sugar mention-
ed in my last, the charge of the *militia* in
Barbadoes is great; for every twenty acres must
find a footman; and every eighty acres a horse-
man. Also every one that keeps a horse must
serve a horseback; and every housekeeper must
serve on foot; which makes six regiments of foot
and two of horse, besides a life-guard for the go-
vernor of a hundred gentlemen. This is done in
a place no bigger than the *Isle of Wight*.

Beside their charge, their *casualties* are great.
Their *canes* are often burnt when they are ready
to cut, they are then like tinder, a fire among
them consumes presently a whole field. Also their
boiling-houses and *still-houses* are very subject to
fire.

Sometime they suffer by extream *droughts*, and
sometimes by violent *rains*, and a sudden gust will
tear or maim their *windmills*. But if a hurricane
comes, it makes a desolation, and puts them to
begin the world a-new.

Their *negroes* are extreamly casual; they com-
monly lose a third part before they come to be
serviceable. When they are season'd, they stand
much better; but are subject to divers mischances.
If a *stiller* slip into a rum-cistern, 'tis sudden death;
for it stifles in a moment. If a *mill-feeder* be catch'd
by

by the finger, his whole body is drawn in, and he is squeez'd to pieces. If a *boiler* get any part into the scalding sugar, it sticks like glue or bird-lime, and 'tis hard to save either limb or life. They will quarrel and kill one another upon small occasions. By many accidents they are disabled and become a burthen. They will run away, and perhaps be never seen more: Or they will hang themselves no creature knows why. I have been told they will sometimes starve themselves out of revenge to their masters. Sometimes there comes a mortality among them which sweeps a great part of them away.

When this happens, the planter must have more negroes, goods, or credit, or his work must stand still, and he is ruin'd at once.

These are some of the charges and casualties that attend plantations. It would be too tedious to number all, and are hardly to be number'd.

Notwithstanding all this, I do not hear but that at *Barbadoes* they live very well: And I have heard an observation from the ingenious Sir *Christopher Wren*, that no place thrives so well as those where getting their necessaries is very chargeable, and there is need for many hands: For 'tis impossible that place should be poor, where there is a multitude of people. Thus much for the history of sugar. I am

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRI-

FRIDAY, Septemb. 16. 1698. NUM. CCCXXI.

*An epitome of the twelve volumes. A
description of saffron*

IN my first volume is the nature of *earth, water, air, and fire*, with their effects, and reason of many of their operations: In my second, *natural history*, with the *taxes, acres, houses, &c.* in each county of *England and Wales*, with notes, particularly of *Yorkshire and Derbyshire*: In my third, the doctrine of *fermentation*, history of *cyder and clay*: In my fourth, a continuation of *clay*, and all its uses I could learn, with the history of *wheat*: In my fifth, the history of *joint-stocks and kine*: In my sixth I went on about *kine*, shewing the use and manufacture of most parts, the doctrine of *nutrition, circulation* of the blood, with reasons of its ascent, and manner of growing of *bones* and other parts: In my seventh I have carried on the history of *kine* in discourses upon *blood, butter, cheese, cows, cream, dung, milk, urine, whey*, and other particulars: In my eighth is an account of the ships that came from abroad to *London* from *New-years-day* 1694, to the same day 1695, with the number from each Prince's territories, and of all the goods imported that year, mentioned in the bills of entry, with the quantities from each place, and all together.

Upon these I have made some notes *natural and political*, as the advantages of a *coalition* with *Scotland*, the true case of a *free-trade*, a *regulated company*, and a *joint-stock*, with an easy and certain method for mending the roads, &c. In my ninth,

ninth, are histories of imported *stone, glass, salt*, and a farther account of roads: In my tenth, a farther account of *salt*, the history of *nitre, gunpowder*, profits of the *Indian trade*, history of *vitriol, copperas, brimstone, okre, jett and coal*: In my eleventh are the farther histories of *coal*; also of *arsenick, lapis hæmatites*, and the seven metals, with a description of all things I could learn were made from them, with some discourses about *air, alkali, colours, exchange, fire*; the manner of fluxing with *mercury*; *money, poison, trade, pumps and wood*: In my twelfth I have given a division of *plants*, the histories of *mushrooms, wheat, rye, barley, oats, canes and sugar*, with all the historical and political notes relating to them I could think proper, as the *quantum* of *beer and ale* that paid excise in divers years, the quantity of *malt* brought from *Ware* by water in a year, with a discourse about navigable rivers, and making them so; the difference about water and land-carriage, with the quantities of *sugar* and the other things imported: In this thirteenth I shall give the history of *saffron*, and other things that have been imported, and go on as well as I can, endeavouring to make it the best account of *trade* upon the best and most sure foot that ever has been yet published, and I could hear of: And all this I have applied, and will apply for the benefit of my country, not doubting but it may be made the richest and happiest the sun sees.

Saffron is one of the *perfect graminious herbs*, of long leaves, having bulbous roots and flowers, whose fibres grow from the bottom of the bulb, having the roots made up of several coats encompassing one another, having naked flowers

of HUSBANDRY and TRADE. 331

ers without any stem, bearing a lesser flower and narrower leaf than *meadow-saffron*.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, Septemb. 23. 1698. NUM. CCCXXII.

*An account of the culture of saffron, &c.
Its use. Where it grows. Its abuse. How
much imported anno 1694, 1695. Whe-
ther best to prohibit or heighten its duty.
Onions, their description. How many and
what seed imported, 1694, 1695. Whence
we have our seed.*

IN my last I gave you a description of *saffron*, and in my second quarto volume of a *Collection of Letters* for improvement of *husbandry and trade*, I have given you its culture at length, where I have given you an account what ground is best, and what worst; how to *plow* and *dung* it, also to plant the *beads*, with the instrument for *planting*; as also how to *hough*, *weed*, *gather* and *manage* the ground the rest of the first year; the management of it in the *kiln*, with a description of the best *saffron*. That an acre of good ground yields usually from *twelve* to *twenty* pounds of *saffron*. There is also shewn the *charge* of management, and the probable profits clear of all charges. I have there also given the description of the *saffron-kiln*, and refer you to the place at large.

Altho' *saffron* will *tinge* much, yet some tell me 'twill not hold; and I cannot learn that 'tis used for *dyeing*; but its chief use is in *physick*, and there 'tis used much, and is a most excellent medicine in a great many cases, as may be seen in its history written at large in Mr. Ray's large *herbal*.

The chief place in the world that I can learn of, is at *Saffron-walden* in *Cambridgeshire*; from whence comes the great quantities, tho' I have seen some excellent *saffron* from *Herefordshire*, and see not but it may be had from a great many counties, where their *soil* is *light* and *sandy*.

We have also *saffron* from *Spain*, and several other places, most of which is called *Spanish-saffron*. This is a sort much worse than of our own growth, and of much less value; altho' of late some have gotten the art to mix *English* and *Spanish* together, as to make it difficult to know the *best* from *counterfeit*.

There was imported anno 1694, 1695, as prize, 46*l.* from *Portugal*, 1*l.* from *Germany*, 50*l.* from *Holland*, 86*l.* and from *Spain*, 579*l.* in all, 768*l.*

Whether for encouragement of our own, 'tis best to make a prohibition of foreign, or to lay a higher duty, I won't determine: But seeing it can be brought in a small quantity, and so be liable to be smuggled, I question whether either will do any good.

The next in course are *onions*, which is a *graminious* plant of a *bulbous* root, and considerable for its strong *scent*, whose leaves are more *long*, and their scent less *strong* than some others, being of the *greater* sort, whose roots grow *single*, with hollow *tubulous* leaves, the stalk *swelling* out middle.

of HUSBANDRY and TRADE. 333

Of these there came in the years 1694, 1695, from *Holland* three barrels, from *Portugal* three barrels, and from *Flanders* one barrel. Likewise of *onion-seed* from *Germany* about twelve hundred weight, from *Holland* about eighteen hundred weight: In all, about thirty hundred weight.

I do believe we are much improved in our *onions*; for I remember since we used to have abundance from *St. Omers* in *Flanders*, but our best *onion seed* we have from *Strasbourg*; and there are like to have them: For I am told our own seed does not do so well as foreign.

Their uses are known in every *herbal* and *kitchen*. Some say they are good for the *stone*, because their juice will dissolve it outwardly; but I am afraid its virtue is spent before it comes to that part.

Yours

JOHN HOUGHTON, F. R. S.

FRIDAY, Sept. 30. 1698. NUM. CCCXXIII.

Tuberoſe, its deſcription and uſe. How much imported 1694, 1695. A propoſal. Aſarum, its deſcription and quantity imported. Roſ ſolis, its deſcription, virtues, and vices. How much was imported. Gentian, its deſcription, uſes, and quantity imported.

THE next imported plant in courſe is *tuberoſe*, which, I preſume, is the *tuberous flower de luce*, which is an herb of affinity to *bulbous* plants,

VOL. II.

Z

334 *A COLLECTION for Improvement*

plants, and is esteemed of for its *flower* growing in the *drier* places, and is an *European* plant, whose flowers are of the larger sort, of a *tuberous* root, whose leaf is like the blade of a sword. I know not of any use other than for *show* and *scent*, both which are very fine: Here about *London* they are kept in pots, and commonly set into the best rooms of state before the chimney. Our finest ladies also stick them to their stomachers as one of the finest adornments they can place there.

There was entred *anno* 1694, 1695, from the *Streights* one thousand of roots.

I do not know that they can be managed so here as to be fit to set the next year, or at least to be so good as from abroad, altho' I wish our gardeners would strive to make them so; or, at least wise, that all our gentry would endeavour as much as in them lies, always to have them in, or as their nosegays. For the only way to get among us all the fineries in the world, is to use them plentifully; and if we use them, others will; and we being the great merchants, I doubt not but quickly to get more by what we sell, than will pay the first cost of all we consume. I would fain have *England* the magazine of all the useful things in the universe.

The next is *asarum* or *asarabacca*, which is an herb of a round *leaf*, of the *lesser* sort, whose flowers do stand singly on long *foot-stalks*, growing in the *drier* places, whose leaf being more *thick* than some other of the kind, and somewhat resembling *ivy*. The leaves are of a strong *purgative* quality, the flowers *small* and of a *dirty* colour.

I know of no use for this except in physick.

There was in the aforesaid year imported of the roots 254*l*.

of HUSBANDRY and TRADE. 335

Ros Solis or *Sun-dew* is also an herb of a round leaf, and the *lesser* sort, whose flowers do stand many together, a *terrestrial* plant, growing in *spike*, with *red hairs* upon the leaves retaining the *dew*, and growing in *moist* places. Some commend it inwardly in *physick*, others forbid it, and Mr. *Ray* joins with them; because 'tis a *caustick*, and will exulcerate if applied to the skin.

This plant is thought very hurtful to *sheep*, for it burns their *lungs*, and stirs up a *deadly* cough, which is called the *red rot*, and 'tis observ'd here in *England*, that *sheep* that eat it much have their *liver* and *lungs* ill affected.

Notwithstanding this there is a water made of it; and there was imported of it from the *Streights* in the aforefaid year six quarts.

The next is *Gentian* or *fell-wort*, an herb of *nervous* leaves of the *terrestrial* kind, growing in *dry* places, and distinguished according to the *flower* of one leaf, being of the *greater* sort, in fashion of a *bell*, having a *bitter* taste, and being of the *taller* and *larger* sort.

The *root* only is used; and in Mr. *Ray* 'tis highly commended in divers physical uses. Some think it to equal *Jesuits bark* for the cure of *agues*; and there is a story of a boy that was cured that had lost his eye-sight a whole year, by boiling the root in wine till half was evaporated, and then 'twas often injected into his eyes with a syringe.

'Tis very much used of late in *bitter* decoctions; also the vintners sell *gentian* wine, and I have divers times sold it to brew with instead of *hops*.

There were imported in the aforefaid year from *Holland* 3205 l.

Yours

JOHN HOUGHTON, F. R. S.

Z 2

FRI-

 FRIDAY, Octob 7. 1698. NUM. CCCXXIV.

Aloes, its description. Whence brought. How the gum is made and called. Barbadoes aloes. The leaves not bitter. Its uses.

THE next in course is *aloe*, which is one of the *perfect herbs*, and is distinguished by the *texture* of the leaf, being succulent, having *thick juicy leaves*, covered with a close membrane, through which the moisture cannot easily transpire; which makes it continue in dry places, and it is of the biggest kind, whose leaf is *long, sharp, and indented*.

The chief place, where the thickened juice of this plant is gotten, is the isle of *Socotora* in *India*, from whence its name of *aloe succotrina*; but there are very good in divers places.

It is extremely bitter, and the manner of making it is thus: From the leaves being pull'd from the roots with a hand or instrument, and press'd, distils a juice. Of this juice the thick parts will subside, and the more thin are pour'd off, and put in the sun till it grows together and dries; in which time 'twill gain a *yellow colour*, and this is called *aloe succotrina*. The *thicker* part that remains, is put into another vessel, and by being thickened in the sun, it gains a *liver colour*, and is called *aloe hepatica*, and the most *thick* part is called *pars caballina* or horse aloes. The juice flowing out of it self has a *golden colour*.

In

of HUSBANDRY and TRADE. 337

In *Barbadoes* and *Jamaica* this plant thrives very well, and they make a great deal of the *inspissated gummy juice*, which they transmit to us in the shells of gourds. And truly it differs little (that I can learn) from the best aloes, only it has a very strong smell; but whether time or art will mend it I know not.

Mr. Ray, in his *history of plants*, gives a large account of it, and of about thirteen sorts: And also that tho' 'tis so bitter, yet the leaves have no bitterness at all in them, but rather an *insipid mucous* matter.

He also tells us from *Francis Hernandez*, that it is useful to all purposes of human life; for the whole of it serves well for the use of the *carpenter*, and for *fences*, the *stalks* for *timber*, the *leaves* for *coverings* of houses, the *nerves* and *fibres* serve in room of *hemp*, *flax*, and *cotton*, and will make *shoes* and *vestments*. Of the prickles are made *nails* and *auls*; also *pins*, *needles*, *pikes*, and such like.

From hence also (if rightly tapped) may be drawn *wine*, *honey*, *vinegar*, and *sugar*, and what is very wonderful, from one plant only may be drawn fifty pitchers full, of nine gallons each; for the juice by distillation will become sweeter and thicker, till it becomes *sugar*.

The *wine* is made with the juice diluted with water, to which are added lemon-peels and such like; and with the sugar dissolved in water and sunned nine days is made vinegar. In physick 'tis used abundantly, hardly a *purging-pill* made without it. It is a prime ingredient in *elixir proprietatis*, and *species hieræ picæ*, with which the *tinctura sacra* is made, and what not; but I'll refer you to the aforesaid

history, where 'tis treated on at large from *Fol.*
1195 to 1200.

Yours, &c.

JOHN HOUGHTON, *F. R. S.*

FRIDAY, *Octob.* 14. 1698. NUM. CCCXXV.

An aloe-tree in flower in England. The manner how divers nations dispose of their dead, particularly the Jews, &c.

IN my last I gave some account about *aloes*. Had there been room I should have told you that the *aloe* plant grows to a great height in some countries, but seldom here in *England*, although my very good friend at *Lambeth*, Mr. *Verſpriet*, had one I believe twelve or fifteen foot high, and in flower, which was a very great rarity here, and such as had not been in 100 years before.

In the ancient embalmings *aloes* was a prime ingredient; therefore something of *embalming* and managing the dead will come properly in here.

Gabriel Clauder, a *Saxon*, has writ a book about it. He tells us that the *Brachmans* and some others used to give their dead human bodies to be devoured by *vultures*, the *Hircanians* by *dogs*; that the *Greeks*, *Romans*, *Gauls*, *Germans*, and other nations used to *burn* them; some cast them into the *sea*, some into *rivers*, and some buried them in *snow*; but the most ancient was to bury them in the earth. In *Japan*, *Peru*, *Pegu*, *Mexico*, *Calicut*, *Tartary*, *Asia*, *Siam*, under the Great
Mogul,

Mogul, and several places of *India* they burn still; and not only the mean ones, but the greater and greatest; their fires being made with aromatick woods, gums, balsams, and oils to a very great value.

This was a custom among the *Jews* in *Saul's* time: For the two last verses of the first Book of *Samuel* tells you, "That all the valiant men arose, and took the bodies of *Saul* and his sons from the wall of *Bethshan*, and came to *Jabesh*, and burnt them there. And they took their bones and buried them under a tree at *Jabesh*, and fasted seven days". So in 2 *Chron.* c. 16. and two last verses: "*Asa* slept with his fathers, and they buried him in his own sepulchre, which he had made for himself in the city of *David*, and laid him in the bed which was filled with sweet odours, and divers kinds of spices prepar'd by the apothecaries art; and they made a very great burning for him."

It seems this burning was not only to please the humour of men, but *God* himself approved of it. For in *Jer.* 34. v. 5. *God* saith to *Zedekiah*, "Thou shalt die in peace, and with the burnings of thy fathers, so shall they burn odours for thee." On the contrary, in the 2d of *Chron.* v. 19. for *Jehoram's* wickedness; "the people made no burning for him, like the burning of his fathers."

The *Tivitivæ*, a people upon the river of *Ora-noque* in the kingdom of *Guiana*, lament much the death of their great ones; and when they suppose the flesh, by the help of the putrefaction fit to be separated from the bones, they do separate it, and hang the skeleton in the house, and the skull they adorn with divers coloured feathers, and fasten golden plates to the arms and legs.

340 *A COLLECTION for Improvement*

And the people of *Guiana*, called *Arwacæ*, powder the bones of their great ones, and drink it in some ordinary drink.

Another people of *Brazil* lament much the loss of their kindred, and afterwards they paint them with divers colours, and wrap them in silk to keep them from the earth, and so bury them.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, *Octob.* 21. 1698. NUM. CCCXXVI.

Farther ways of managing the dead.

IN my last I gave some account about managing the *dead*. I now go on and tell you further, that some of the *Brazilians* put their dead into a round deep pit, that they may be there placed standing upright.

Another sort in a horrid manner give way to their death, and shew their sepulchres; for when the hopes of recovery from sickness is past, they by common consent kill him with a club, and he in the time of the blows rejoices.

When dead, the priest cuts him into pieces, which some old women toast at the fire, mixing with them their tears and mournful out-cries. The women devour the flesh, hardly leaving the solid bones, which they powder against the next feast, and swallow with water; and this they do not out of any malice, revenge, or hunger, but as a peculiar sign of their fidelity and love.

I

When

of HUSBANDRY and TRADE. 341

When a *chief* dies among the *Canibals*, his corps is put on a carriage, and thrust to and fro before a gentle fire, that so all the moisture may be dry'd up, and nothing left but skin and bones, which afterwards they keep as sacred.

In the Kingdom of *Tranziane* the dead are washed, and the heart and intestines are burnt with *aromatick* woods, in honour of their God. After this the *ashes* are put into the belly, that nothing may be wanting in the future resurrection.

It is often among the *Chineses*, that the children keep the corps of their parents three or four years, and they know so well how to stop the chinks of the thing they put them in with *bitumen judaicum*, that their corruption shall not add the least offence to the smell. I presume my author means lacquer'd vessels.

In the island of *Formosa* they put the corps in an elevated place, and a fire is set at some distance nine days till the corps be dried; and they do not much mind the ill smell: After well dry'd, 'tis kept three year, and then buried.

They burn the bodies of the *western Tartars*; and in company of their kindred and friends they carry what's left to a heap with great joy and dancing.

Others hang 'em on trees for three years, till they are dry, and then they remove and burn them.

The *Cyrcaessian Tartars*, tho' they are very barbarous, and live in most vile cottages, yet they honour their *dead* with *solemn exequies*, and build wooden houses over them variously *painted*.

The *Hyrceanians*, *Parthians*, *Caspians*, and *Bactrians*, devour their *dead* with *dogs*, *vultures*, and other beasts kept for that purpose.

So

So the *Chii* and *ancient Romans* were wont to burn their *dead*, and the bones being beat in a mortar, and sifted to a fine powder, were thrown into the air to be dispers'd by the winds.

The *Scythians*, *Massagetes*, and *Derbiri* did kill their *ancient parents*, and then did boil 'em; and being met at a solemn *feast*, did eat 'em.

The *Effedones* celebrate the death of their *parents* with songs; and getting an assembly of their *neighbours*, they eat their corps mix'd with mutton.

'Twas the manner of the *northern people* near the *Riphean* mountain to bury their dead in the water.

The *ancient Scythians* put their parents in trunks, and buried them between the ice and snow.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, *Octob.* 29. 1698. NUM. CCCXXVII.

Farther accounts of burial. The reason why the Ægyptians embalmed.

I Come now to give more accounts about *burial* of the *dead*.

The *ancient Romans*, besides other sepulchral honours, did sometimes paint their virgins and other dead bodies in the face, that some of the dead look'd fairer than if they were living.

Sometimes when a King of the *Scythians* died, they dug a very great square pit, where cover-
ing

ing the body with wax, they took out the *entrails*, and beating them with *osiers* till empty, they fill'd 'em again with *thyme*, *smallage*, and *anniseed*, and putting 'em into the belly, they sew'd it up again, and in a chariot carry'd it to some other country, which, when that people receiv'd, they did the same thing. They cut the ear, they clip'd his hair round, they cut his arms, they wounded his forehead and nose, and thrust darts through his left hand, and afterwards carried his corps in a chariot to another nation over whom he ruled; some of which nation accompany'd 'em to the place from whence they first came; and when they had carry'd him to all the countries over which he rul'd, they bury'd him among his ancestors.

And not only among the ancients, but at this day among divers of the *Indians*, when a man dies, his *wives* and *concubines* are kill'd, burnt and bury'd with him, and with the Kings and great men, even to hundreds and thousands. It is a reproach and shame for any of 'em to prolong their lives by refusal of this.

In *Japan*, to hinder being kill'd by others, they'll rip their own *bellies* with sharp knives, thinking it a generous action so to do, and some will do it only to prevent *sickness*.

In the *West-Indies* (when the *Spaniards* came there) they found several carcases of the *Indian* Kings, with their *grandfathers* and *great-grandfathers* in certain vaults which they kept as an effect of their piety, and adorn'd 'em according to their degrees, with gold and jewels.

The *Nabatheans*, a people of *Arabia*, used to bury, not only the ordinary rank, but their Kings in dunghils.

The

The *Ægyptians* were so famous for preserving their dead, that when *Augustin* came into *Ægypt*, they shew'd him the bodies of *Alexander* the Great and *Ptolemy*, who had lain a long time in their *sepulchres* without diminution of their skin or members.

The reason why the *Ægyptians* thus preserv'd their dead was, because they having suck'd in the doctrine of the *Stoicks*, believ'd the souls to remain alive so long as the bodies were uncorrupted.

Others thought like *Pythagoras*, after many years the soul would return to the body, which was impossible to be, when it was either corrupted or burnt.

This custom of the *Ægyptians* was carried to several other Nations, particularly to *Canaan*; witness the bodies of *Jacob* and *Joseph*, and it was also in use at the death of *Christ*, witness the designs of the *women*, *Joseph of Arimathea* and *Nicodemus*.

The manner of the *Jews* burials was to wash the body, the eyes, bind the mouth, stop the vents, shave the head, anoint the body with perfum'd ointments, and then wrapping it in clean white linen clothes which were not costly; because there should be no great inequality between the rich and poor: They also cover'd the face with a handkerchief, not exceeding the fourth part of a *cycle* before they laid him on the bier.

Yours

JOHN HOUGHTON, F. R. S.

FRIDAY, Nov. 4. 1698. NUM. CCCXXVIII.

More ways of managing the dead. The Ægyptians were famous for embalming. As likewise the Romans. A censure on sepulchral lamps. Embalming came from the Hebrews to the Christians.

THE *Peruvians* with a certain rosin (which some think to be from the tree *copaibæ*, perhaps *balsamum capivii*) used to keep their dead *Kings* and great men for 200 years.

The people of *Chili* used to preserve them with *herbs* and *spices*, from ill smells and corruption for divers months, and then to bury them with divers ceremonies.

In the Kingdom of *Tranzian* they used to bury them near the mountain *Culma*, being fill'd with aromatick powders, which by help of the dry winds would not suffer them to corrupt.

In the *Mogul's* country, when a rich *Braman* dies, his body is embalmed, and after eight days burnt with great pomp.

The *Æthiopians* did not only dry their dead, but cover'd 'em over with *Gypsum*, and painted to the life, so that being put into glass, nothing might smell ill; they put these in the city to be seen, and offered their first fruits and sacrifices to them.

By which it appears that none are like the *Ægyptians* for embalming; witness the *mummies* now known in several places, which some think have

have been kept above 3000 years, and are turn'd as it were to stone.

But the *Romans*, as they drew wisdom from the *Ægyptians*, so *arts*, and those that were *sepulchral*, and in some things they out-went 'em; for in the Papacy of *Paul III.* in the *Appian* way, where abundance of the chief heathens of old were laid, a sepulchre was open'd; where was found the entire body of a fair virgin swimming in a wonderful juice, which kept it from putrefaction so well, that the face seem'd no way damify'd, but lively and handsome. Her hairs were yellow, tied up artificially, and kept together with a golden circle or ring. Under her feet (my author says) burnt lamps, which vanish'd at the opening of the sepulchre. By some inscriptions it seem'd she had lain 1500 years. Who she was is not material, although many thought her to be *Tullia* the daughter of *Cicero*.

How lamps can burn, being shut from the air, I know not; neither was it possible, if they had burnt, to have lasted so long without consuming.

Cælius Rhodiginus gives some different account of this affair; but both agree in the main, although some think her body was burnt.

Embalming came from the *Hebrews* to the *Christians*, among whom, to preserve the great men, it was customary to open the belly, take out the intrails, and in their room to fill up with balsamick matter.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, *Novem.* 11. 1698. NUM. CCCXXIX.

*The manner how the Jews manag'd
their dead.*

MY author goes on and tells the manner how the *Ægyptians* and others did *embalm* their dead, and gives various receipts of the materials they were done with: also there are great variety of inventions since; but these belonging chiefly to those that are concern'd in physick, to my author I'll refer 'em.

Godwin, in his *antiquities*, gives an account of the *burials* of the *Jews*, *Greeks* and *Romans*, which I shall epitomize, and begin with the *Jews*.

At the time of death, the next of kin closed the eyes; then was the body *wash'd*, and then *embalm'd*; which in likelihood was learn'd from *Ægypt*, for *Joseph* is the first we find that practis'd it, *Gen.* 50. 2. When they did not design to keep the body long, they used an external application of spices and odours without embowelling; and this was done to Christ, *John* 14. 40. Sometimes they burnt the corps, preserving the bones in an *urn* or *pitcher*, *Amos* 6. 10. but commonly they buried the whole body in the Earth.

The ancient *Jews*, if they had none by descent, purchased a burial-place for themselves and family: and its form was a vault hewn out in a rock, six cubits long and four broad, in which several other lesser holes or tombs were made;

348 *A COLLECTION for Improvement*

made; and on the mouth of this they were wont to roll a great stone. *Mat. 27. 59, 60.*

The wealthy would paint and beautifie the entrance of them: hence the phrase, *painted tombs*. When they used to mention a dead friend they used that in the *Proverbs*. *The memory of the just is blessed. 10. 7.* Hence the *Rabbies*, when they spake of any worthy author deceased, they used to say, *such or such an one of blessed memory*. And their usual epitaph was, *let this soul be bound up in the garden of Eden; or, in the bundle of the living. Amen. Amen. Amen. Selati.*

They made a feast at their burials which is called the *bread of men*. *Ezek. 24. 17.* and a *cup of consolation*, *Jer. 26. 7.* From these places may be observ'd, that they used first, *cutting themselves*, which was forbid. *Deut. 14. 1.* Secondly, *making themselves bald by shaving or plucking off their hair*, or by *plaisters to make it fall off*, which was likewise forbid. *Deut. 14. 1.* Thirdly, *going bare-headed*, that they might *cast dust or ashes thereon*, signifying *they were unworthy the ground they went on*. Fourthly, *going barefooted* for their greater humiliation. Fifthly, *the covering of their lips*, which was a special sign of sorrow and shame. *The seers shall be ashamed, &c. They shall all cover their lips*, for they have no answer of God. *Mich. 3. 7.* Sixthly, *renting their clothes*. Seventhly, *putting sackcloth about their loins*. *Gen. 37. 34.* These were used upon all extraordinary occasions of sorrow. Two other, more proper to burials, to augment grief, *viz.* First, *minstrels, viz. Trumpets* for the great, and *pipes* for the mean. When *Jesus raised Jairus's daughter*, *he cast out the minstrels*. *Mat. 9. 23.* Secondly, women hired to sing at burials, and by outward signification of sorrow to move

of HUSBANDRY and TRADE. 353

move the company. *Call for the singing women. Ec. and send for skillful women. Jer. 9. 17.* Thus much my author for the *Jews*. Next Friday expect more from

Yours Ec.

JOHN HOUGHTON, F. R. S.

FRIDAY, Novemb. 18. 1698. NUM. CCCXXX.

An account of the Greeks, how they managed their dead. They were extraordinary fearful to dye at Sea, and why.

IN my last I gave an account how the *Jews* managed their *dead*. Now for the *Greeks*, according to Mr. *Francis Rous*; and he tells us, if any met by chance with a dead corps, and did not cover it three times with earth, and give it a mouth-full of Turf, it was a great crime; therefore they were fearful of going to Sea, lest by being drown'd, they should lose both body and soul; for being at the bottom of the Sea, they reckoned no burial; therefore their custom was to fasten to some part of their bodies a reward for him that should find and bury them, if they were cast ashore.

'Twas also a great concern to 'em to think they should not be buried in their own country.

If any man kill'd himself, they cut off the hand that did it, and buried it apart from the body. If any kill'd another, and as he thought justly, he wash'd his hands, (as he would after killing any other creature) and held the sword

348 *A COLLECTION for Improvement*

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'twas kill'd with towards the sun, with the blood on to shew, he fear'd not if heaven and all the world were witness. If unjustly, he wip'd off the blood with the dead man's hair, to abominate and wipe away the abomination of the fact: but if it were one of his own tribe or kin, he could never wipe so clean but some would stick; and therefore fearing the furies would revenge it, they provided *amulets* and *spells* to keep them off; and thought nothing better than a part of the dead body; for they believed the ghost would not hurt them for fear they should spoil those parts; or for love of the carriage; and therefore as soon as slain, they cut off the extream parts of the outmost members; and sewing or tying them together, wore them under their armpits.

If he had killed the man by treachery, he hung those parts about his neck, and taking some of the blood, spit three times in his mouth.

When a man was dying, or the sun was setting, as they used to say, the parents, or next of kin closed his eyes, and 'twas esteemed a great misfortune, where it could not be so done: also covered his face with a cloth stretch'd out and cover'd the body.

Into the dead man's mouth they put a piece of money above a half-peny to pay *Charon*, and with it they threw in a morsel of *pudding* or *passe*, or *cheese*, to stop the wide mouth of *Cerberus*. Some say they were to carry a piece in each Hand

If the party deceased were free of the city, they took out his bowels and with heated water wash'd the body, and then anointed it with ointments, and poured *ambrosia* upon his head and face; which done, they wrapped it in a fine garment woven (it may be) long before by his wife

wife or some other friend for the purpose, having also bands or lists of cloth to tye the hands and feet with. The colour of the *shroud* among those *Grecians* was *white*, although the *Latins* was *black*.

This done, they trimmed him with *garlands*, as they would do to one that had run out his race, or fought it out. This done, they set him on the ground with his feet outward toward the gate, as being never to put his foot in the house again. Next week expect more from

Yours, &c.

JOHN HOUGHTON, F.R.S.

FRIDAY, *Novemb.* 25. 1698. NUM. CCCXXXI.

*A farther account how the Greeks managed
their dead.*

AFTER the dead body among the *Greeks* was embowell'd, wash'd, anointed, wrapt, bound, garlandized, and set for a walk, then they put him in a couch or bed, to be in readiness to be carried to his bed or grave. The couch was also adorn'd with garlands made of divers sorts of herbs and flowers, but especially olive, which they used in victories. Having thus adorn'd it, they set it forth at the doors which they called laying forth; and all the time till it was carried forth, there stood at the door a great earthen vessel fill'd with water fetch'd from another house for the people to wash in that came in and out.

At break of day up the corps was mounted and carried along most bravely in pomp, as if it were intended for a shew.

If the party died in a fight, they carried along with the corps spears, and other arms and armour.

As it was carrying from the porch, they used some speech to commend him for his virtues, or to recommend him to the Protection of the infernal gods, or to bemoan his departure.

Those that accompanied the corpse sometimes went on foot (if it were one whom they honoured much) and sometimes in a coach. If it were a publick person, or one of great note, they were all clad in white, and adorned with garlands. In going to the grave, the men walk'd stately before the corps; and some women (above sixty, or of kin to the party) came whining behind.

To set forth the mourning with a better grace, they had their singing women.

Those that came to the funeral brought along with them one *fine* thing or other to carry in their hands or put on the *coarse*; some think they were the images and arms of the family of the party *deceased*; but there was a great deal of *difference* in the pomp according to the age of the *deceased*.

The *Grecians* upon any extraordinary occasions of sorrow used to cut their hair, or to shave it close to the skin.

When any died, such as was near of kin (it being a time for sadness) they *forbare* to drink any wine, and confin'd themselves to a barley-mash (ale, it's like) and they used to *tear* their clothes and their hair, and sometimes to throw their *veils* in the fire in sobbs and sighs, to throw
their

their faces in the dust, or the dust in their faces, and sometimes ashes: also to beat their breasts and thighs, and cut and tear their flesh, making streaks and furrows with their nails in their face, to repeat the interjection *¶*, *¶*, *¶*, *¶*.

But at a funeral they were so immoderate (especially the women) that when they came forth of the house (and not only at the grave) every one lopp'd off a lock of his hair.

As they went along with the corps, they kept their heads close cover'd and their faces; they used also to lay their hands upon their heads, as we do our heads upon our hands. Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, Decemb. 2. 1698. NUM. CCCXXXII

A farther account how the Grecians managed their dead. How they burnt them.

BESIDE what I have said in my last, the people that were at the burial (except those got on purpose for weeping and singing) used to go treading as softly as they could, and making no noise with their tongues.

When they came to the place of burial, they cut off all the best locks of their hair, and laid them on the grave, or cast them into the fire for to make them look *squallid, careless* and con-

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temptible;

temptible; for long hair was a token of their pride.

During the whole time of mourning (which *Lycurgus* confined to eleven days) the women wore no jewels; neither was there to be fire or candle light. When mourning was for a publick calamity, all the *wrestling places* and *fencing schools* were shut up, with the *baths*, *shops*, and even the very *temples*.

The ordinary way the corps was carried, was through the gate that led to the graves or burial place (in the scripture phrase, the *gates of hell*.)

Anciently they buried their Kings at the foot of a hill, to shew that he was not a *mountain* for ever. But for men of low rank, they only made a pit or cave.

In after-times they had a *burial place* within the walls, and another without, call'd the *burials*, or the *berries* (whether our *berries* came from hence is enquirable) that within was for those that made an honourable end in the *field*, for the good of the *commonwealth*.

At the *place* of burial they used first to burn them, because the body might consume presently; but some dislik'd this way, and so sometimes they would *burn*, and sometimes *cover* with earth, altho' burial by burning was *esteemed* the more honourable, as may appear by their unwillingness to have it common: for they deny'd it to *infants*, to such as kill'd *themselves*, to such as were kill'd with *lightning* (which were bury'd in some peculiar place as we do *felo's de se*) and to *traytors*, on whom they were loth to bestow any burial at all.

The manner of *burning* was to make a pile of wood, and having laid the corps on the top, to set it on fire. The wood was sometimes *oak*, sometimes

Sometimes *olive*, sometimes *pine*, and if the party had lost his life by shipwrack, they made the fire of the *planks* of the ship.

All the while 'twas burning, the *mourners* stood round the *bonfire*, and pray'd to the winds to blow, to make it burn the better; it's thought not to put the *carcass*, but *themselves* out of the pain.

If there happen'd to be a very strong wind, they embrac'd it as an *excellent* omen. And there was always a *bell-man* to keep off any that would *meddle* with the bones.

When all was burnt to the *bones*, the next of kin *quenched* the fire with *red wine*, and afterwards swept the *ashes* into a heap, and the *bones* they wash'd in water brought in pots for that purpose, and having anointed them with ointments and the fat of a sow, they wrapt them in *fine linen*, and put them into a coffin commonly of *cedar*, which is longest in rotting, and is therefore call'd the *life of the dead*. Some will have it to be a pot, and gilded, and some will have it *stone*; but whether any had *cedar* besides those that had vaults under-ground to lay 'em in, my author is at a loss.

The *Athenians* seldom put above one man's *bones* in a coffin; but the *Megarenses* many times four. The *bones* they called *relicts*, and they were thus kept, lest they should be exposed to the rage of *too deadly enemies*.

If the party were burnt in a *foreign country*, his *bones* or *ashes* were carry'd home in a coffin, and pompously *shewed* and *adorned* with garlands, in every place they came to; cross ways those, that were of kin kept feasts.

After they had laid it up among the *monuments*, they cited the *party three times* to make

his *appearance*, and the coffin was put in a *sepulchre*, common to the rest of the family, only *unbrifts* were excommunicated by law and branded.

Yours, &c.

JONH HOUGHTON, F. R. S.

FRIDAY, Decemb. 9. 1698. NUM. CCCXXXIII.

The farther custom of the Grecks about burial. Their sacrifices. They thought that all Kings and princes souls went to heaven.

THE farther Customs us'd among the *Greeks*, were at a cold burial, (sometimes at a burning too, as the *sacrifice*, the *speeches* and the *plays*,) that the peculiar place was usually chosen before the party dy'd, and mark'd with a black stone: and when he was brought to be bury'd, a heap of earth was thrown upon the body; but for the *better* sort, 'twas made *higher* and *handsomer*, with *stones*, somewhat after the manner of our *tombs*, and they desired to have it polish'd as neat as might be, fast and smooth.

The body usually lay in the grave, with the face towards the east; and sometimes the west. On the *stone* was put the name and condition of the party *deceased*, and commonly in *verse*. *Plato* was for just four *heroick verses*. The *Lacedemonian soldiers* us'd to tye a *ticket* or *note* about their wrists, that in case they should dye
in

in the *field*, they should have a *burial* and a *monument* agreeable to their quality. Having thrown the earth upon him, the next work was to sacrifice and pray, that it might not lye too heavy; which benefit, as they thought it too great to be granted to a wicked fellow or a coward, so they thought it too little to be denied to another.

The manner of *sacrificing* to the *infernal Gods* or *Gods* of the *dead*, was to dig a ditch for the altar, and the victim slain was a *barren cow*, or a *black sheep*; because they suited best with mourning; or it was to the *black Gods* of the dark: afterwards it arose to an *ox*, till it was forbidden by *Solon*, whether it were *Sheep* or *Bullock* or *Hog*, as it was best if it was a spaid or a barren *Female*, so it might not be *Ram*, *Bull* nor *Boar*; for they would not give that to the *dead*, which could beget life in another thing. Not only the *beast* they slew, but all the rest, in time of a publick funeral came under the hands of the *barber*, as well as the *men*.

Beside the *victim*, they had *libations* which was usually *honey*, *milk* and *wine*, to which they added *cakes*. They us'd to go round the *grave*, and pour some of these liquors out of the *bottle*, and then to stand on the top, and do it there too; and as they *offered* they us'd certain *speeches* to the party *deceased*, with *prayers* to the *Gods* and *Ghosts* of the *dead* to be propitious to them.

These *sacrificing offices* were *especially* to be perform'd by the *kindred*.

There were also *garlands* laid upon the *grave* as were upon the *herse* and *corpse*, to honour the *dead* (thinks my author) as they us'd to do the living, when they won the *game*, and for the same reason they threw *boughs* and *leaves* upon

upon the *grave*, and some us'd particularly *myrtle*.

Either upon or close by the *grave* they used to erect a pillar not above three cubits by the law; to it they sometimes added the images of the party, or somewhat else to resemble him. Thus *Diogenes* was honoured with the image of a *Dog*, for being a *Cynick*; and *Isocrates* with the image of a *Syren*, for being an *Orator*. They honoured the *dead* in commending him by *private discourse* at home, at the *feast*, or by a publick *speech*, which if the party died in *battel*, was made by one appointed by the *magistrate* (ordinarily the *father*, or one of kin) and that not only at time of burial, but every year after. They had also *funeral plays*.

Having thus disposed of the body, they returned home, taking no care of the soul, unless it were a King or Prince, whose souls they imagined to be carried into heaven upon *eagles* wings; and they were wont to honour them with the pictures of *eagles*.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, Decemb. 16. 1698. NUM. CCCXXXIV.

The Greeks farther management of their dead. Likewise the Romans.

WHEN the *Greeks* came from a burial, they fell a purging and *lustrating* the house with brimstone, and *themselves* by going through

through the fire, or some other *lustration*; for there were several sorts.

After this they kept a feast, and the *guest* wore garlands, and their apparel was white. This *feast* they renew'd nine days after, and thirty days after, which they sacrific'd to *Mercury*, that he might carry their souls to the fields; and upon the day of his death every year after, and also upon the day of his birth.

They suffer'd none that had been an *enemy* to the *deceased* to bear any part, or come nigh his grave, nor any stranger, lest he had been an enemy; neither was any to add to, or diminish from the monuments.

The *wife*, if she seem'd to be with child, was taken into the care of the chief, lest she might be persuaded to marry with whom she should not; and if any man offer'd to wrong her, the punishment was arbitrary.

The *children* were committed to a tutor; and he that was *overseer*, or *guardian*, was either not of kin, or so far off, that if the child should happen to die, the inheritance should not fall to him. A tutor was by will or appointment of the chief, and he had the management of all the affairs, till the pupil came to twenty years old; and then he, or any that would might sue out a writ, and have him before the *chief*.

But this must be done within five years after the pupil came to age, or not at all. Thus far the *Greeks*.

The *Romans*, when they *perceived* a body dying, the next of kin *received* the last gasp and likewise clos'd the eyes: after which they kept it seven days unbury'd, washing the corps every day with hot water, and sometimes anointed it with hot oil, hoping if it were in a slumber, it might

might by these hot causes be *revived*, and likewise by loud *conclamations* they endeavour'd to raise it from slumber; from which, if it would not rise, it was bury'd, *invested* with such a gown as its office formerly had requir'd. When it was embalm'd, 'twas placed in a bed near the dead man's house, with his face and heels outwards toward the street; and near the bed and gate was *erected* an *altar*, upon which his friends did daily, till the burial, offer *incense*. The gate on the outside was garnished with *cypress*, if the dead were of any note.

In these seven days some provided all things in readiness for the *funeral*, and they were commonly sold in the *Temple of Libitina*. On the eighth day the *guests* were summon'd by a common cryer; and when they were *assembled* (the bed being cover'd with *purple*, or other rich *covering* and the last *conclamation* being ended) a *trumpeter* went before the company (certain poor women following and singing songs in praise of the *deceased*.) But note, only the rich had a *trumpet*, others only a *pipe*, and it was only a *senator* or *chief citizen* that was carry'd on a bed, others in a coffin on a *bier*.

The next of kin carried the corps. The poor whose purse could not bear such solemnities, were buried in the dusk of the evening. I hope this matter will be ended next *Friday* by

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, Dec. 23. 1698. NUM. CCCXXXV.

*The manner of managing the dead at Rome.
They did burn.*

IN the burial of a *senator* or chief officer of *Rome*, waxen images of his predecessors were carry'd before him on long-poles or spears with all the ensigns of honour he deserv'd. Also if any servants were manumitted by him, they accompany'd the mourners, lamenting their master's death. After the corps follow'd the dead man's children, the next of kin, and others of his friends in mourning apparel.

The corps being thus brought to their great oratory, the next of kin made a funeral oration in commendation of the deceas'd, and his predecessors, whose images were present. The oration ended, the corps was in old time carry'd home as brought forth; but afterwards the law of the twelve tables prohibited all but the *Emperor* and *Vestal Nuns* to be bury'd within the city.

Their manner of burial was by burning, to prevent the *enemy* digging up the bury'd bodies; but they would cut off a finger to bury, with a second solemnity: But the aforesaid law, because it caus'd a double charge, prohibited it, except he dy'd in the war, or a strange country.

After the dead body was laid on the fire, they open'd his eyes to show him *heaven*, if possible, and put a half-penny in his mouth to pay *Charon* the ferry-man for carrying the soul over the *Stygian Lake*. About this fire were many *cypress* boughs, to hinder the ill scent of the corps. The corps laid on, the next of kin set fire to the heap with

with a torch, turning away his face. Then *fencers* were commonly hired to combat till one was killed, and his blood serv'd instead of *sacrifices* to the infernal Gods.

The body burnt, the *nearest friends* gather'd up the ashes and bones, which being wash'd with milk and wine, were put into pitchers call'd *urns*, which were laid up two or three in a coffin, in their arched *tombs*: When this was done, towards night they used torches.

The *bones* being gathered, the priests *besprinkled* the company with clean water thrice, and the *eldest* of the mourning women with a loud voice crying *Ire licet* ('tis lawful to go) then did the company depart, saying, *farewel, farewel, farewel*, we shall follow in the order that *nature* permits. The *aged men* were invited after the burial to a feast or banquet, which they eat upon an altar of *stone*. The poorer *received* only a *dole* of raw flesh. There was also a drinking of wine after the burial, which the aforefaid law, to save charges, prohibited, as likewise for the moderating *grief* in the *mourners*, it prohibited a certain word of sorrow call'd *lessum*. Nay, in some cases sorrowing was utterly forbid, in others limited. An infant under three years not to be mourn'd for at all; *elder*, for so many days as they were years old. *Wives* were permitted to mourn for their *husbands*, and *children* for their *fathers* ten months, if they would, within which time the widow could not marry without infamy. And thus much for embalming and managing the *dead*, which I think was not improper under the head of *aloes*; for *Nicodemus* brought for Christ a mixture of *myrrh* and *aloes*, about an hundred pound weight. St. *John* xix. 39.

Yours,

JOHN HOUGHTON, F. R. S.

FRI-

FRIDAY, Dec. 30. 1698. NUM. CCCXXXVI.

*How much aloes imported anno 1694, 1695.
Kelp, its description, and how much of
its ashes imported. What it is, and its
use. The supposed principles of nature.
Those that know her most, pretend least to
understand her. What alkali is.*

I Thought I had done with *aloes*, only I will tell you that in the year 1694, 1695, there was imported from *America* five hundred pounds weight, and 6344 pounds, and two pounds from *Portugal*.

The next imported plant was *kelp*, *calt*, or *glasswort*; which Bishop *Wilkins* says is a *succulent* herb of the *lesser* kind, *marine*, growing in *salt* places, whose leaf is *cylindrical*, the ashes of it being us'd in making of *glass*.

There was imported from *Holland* fifty six pound of *kelp* *ashes*. I take this *cali* or *kali* to be *oyster-weed*, such as is commonly brought in *oyster barrels*, and it from which the word *alkali* proceeds; for it is a plant that by *burning* or *incineration* yields abundance of what is call'd a *fixed salt*: And from it the fix'd salt of other plants are call'd *alkali's*.

In several countries near the sea, with this herb they make *pot-ashes*, which are us'd in a great many works, as washing and whitening of yarn and linen clothes, &c.

Great has been the study among philosophers and physicians, what have been the *principles* of natural things, from which they hop'd to find out the nature of health, that is the due proportion of each principle; and by the different proportions to find out the difference of diseases: And in order to it, the ancients suppos'd *fire, air, earth, and water*; others, since *chymistry* grew in fashion, *salt, sulphur, and mercury*; Dr. Willis *spirit, salt, sulphur, water, and earth*. Others will have it only *water*; and of late some are mighty earnest for *acid and alkali*; and Dr. Morton was for *venom and antidote*, but he meant the same thing as he once told me. That any of these are right, I find the learn'd don't agree, and truly where it does not consist only in such and such proportions, but also in such and such obstructions, and sometimes more than ordinary large passages; sometimes through such and such percolations or strainings, through variety of angulated colanders, and sometimes by different *ferments* and coagulations: Truly 'twill be a difficult thing for those that have study'd nature but a little to hit her right. I find those that study her most are most diffident and modest, and will trust more to their large skill in history of cures, than they will to any *mathematical conclusion* from any principles have been yet laid down, although they that know most in *chymistry, anatomy* and other *natural knowledge*, should know most of *principles*.

That is commonly call'd an *alkali*, which, being mix'd with a fluid *acid*, causes an *ebullition* or *fermentation*: For one of these salts are apt to run into the cavities of the other; or at least to adhere one to the other, as we may see plainly in making *tartarum vitriolatum*: For there the
alkalous

of HUSBANDRY and TRADE. 369

alkalous oil of *tartar*, and the acid oil of *vitriol*, though they are both thin and transparent liquors, will, by fermenting together, let fall a white solid salt; and pearl, mix'd with juice of lemons, will leave it insipid.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, Jan. 6. 169⁸. NUM. CCCXXXVII.

How much madder was imported anno 1694, 1695. Madder, its description. Its use. It delights in our climate. Its culture. How its useful in dyeing: Two sorts of mather. It dyes Bow-dye. Mather increaseth the stuff dyed one ounce in twelve.

THE next thing to *kelp* is *madder*; and there was imported from *Holland* in the year 1694, 1695, 12289 hundred weight, and eighty pound.

Madder is an herb that is *stellate*; so stiled from the manner of the growth of their leaves which encompass the stalk at intervals, like the rays of a star, distinguishable by bearing *lesser flowers*, *ramping*, of *broadier leaves*, having a *red root* used for dyeing.

The sum of what Mr. *Worlidge* says of *madder* in his *Systema agriculturæ* is, that it is a rich commodity, much used by *dyers* and *apothecaries*, and a plant that delights in our climate.

It is to be planted in a very rich, deep, warm, and well manured land, digged at least two or three spade deep.

VOL. II.

B b

About

370 *A COLLECTION for Improvement*

About *March* or *April*, as soon as it springs out of the ground, it is to be there planted. The *setts* are to be gathered two or three inches long with roots to them, and immediately planted or put into mold, if carried far; and then set about a foot a-part, and kept watered till they spring, and continually weeded, till they have gotten the mastery of the *weeds*.

At three years end you may take it up, reserve the *plants* for the use of your self or neighbours, and sell the *roots* to the *apothecaries*, or dry them for the *dyers* use.

Dr. *Sprat*, now Bishop of *Rocheſter*, in his history of the *Royal Society*, gives an *apparatus* to the *hiſtory* of the common practices of *dyeing*, by Sir *William Petty*. Where he ſays (ſpeaking of bran-liquor) I conceive it contributes ſomething to the holding of the colour; for we know *ſtarch*, which is nothing but the flower of bran, will make a clinging paſte, the which will conglutinate ſome things, though not every thing, *viz. Paper*, though neither *wood* nor *metals*. Now bran-liquors are uſed to mealy dyeing ſtuffs, ſuch as *mather* is, being the powder or *ſecula* of a root: So as the flower of bran being joined with the *mather*, and made clammy and glutinous by boiling, I doubt not but both ſticking upon the *villi* of the ſtuff dyed, the *mather* ſticks the better by reaſon of the ſtarchy paſtineſs of the bran-flower joined with it. And a little after,

Mather is a root cultivated much in *Flanders*: There be of it two ſorts, *pipe-mather*, which is the coarſeſt, and *bale-mather*, otherwiſe called *crap-mather*. This *mather* is uſed to the beſt advantage, dyeth on a cloth a colour the neareſt to our *Bow-dye*, or the new *ſcarlet*; the like whereof *ſafflower* doth in ſilk; inſomuch that the colours

of HUSBANDRY and TRADE. 371

lours called *bastard-scarlets* are dyed with it. This colour endures much boiling, and is used both with *allum* and *argol*; it holdeth well: The brightest colours died with this material are made by over dyeing the same, and then by discharging part of it by back-boiling it in *argol*.

Mather is used with bran-liquor, instead of white liquor or ordinary water.

Mather increases the weight of the thing dyed about one ounce in twelve. Next *Friday* expect more from

Yours

JOHN HOUGHTON, F. R. S.

FRIDAY, Jan. 13. 169⁸/₂. NUM. CCCXXXVIII.

Four sorts of mather. The price: To what value imported. 'Twas planted near Wifbich. Planting it here will employ many people. Divers dyeing materials are dearer to English dyers than to foreign.

I N my last I gave some account of *mather*, and told you of *pipe* and *crap-mather*: But I understand since, that little comes from *Flanders* or *Hamburgh*, whence it used to come, but mostly from *Holland*; of which there are four sorts; *crap* the best, *umbero* the second, *gemene* the third, and *mull* the fourth.

The best *mather* is now worth about six pound the hundred, and the quantity mentioned imported from *Holland* in my last paper being about 614 tun and a half, and supposing it some worse and

372 *A COLLECTION for Improvement*

some better, but all together at five pound the hundred, it amounts to sixty one thousand four hundred and fifty pounds (61450*l.*) (a brave article for the circumspect and industrious *Dutchmen* :) 'twill buy a great deal of our *tobacco*. But tho' I think they deserve to get money for their industry, and I value them for it ; yet because I am an *Englishman*, I would be as glad to see *England* get it as they : And this, as I am told, we had once great reason to hope for. It was planted near *Wibich*, and they made a great deal ; upon which the *Dutch* sold theirs so low as forty shillings the hundred, by which means our planters were so discouraged as to lay their plantations by, and I cannot learn now that they make any.

Whether this dearness will again encourage them, or whether the parliament will think it an article worth minding, I know not : But we have now a great complaint that we have over many poor, and ways are contriving how to remedy it. I do say, that 61450*l.* at 10*l.* the head, will keep 6145 persons for a year, although out of it must be allowed the goods we send them for this *mather* : But if we did make all this at home, the *Dutch* must send us so much more money, or other goods in lieu of it, or else go without some of ours, which might enable us to carry them to those markets they do for us.

Truly I do hear by divers complaints, that the *Dutch* are too hard for us in a great many parts of *dyeing*, which is a very considerable article in our general trade : For instance, *Logwood* pays 4*l.* 15*s.* the tun when imported hither, which all our dyers pay : But if it be exported by certificate 3*l.* 16*s.* is drawn back, which helps others so much, freight deducted. Something like

his is also in *Indico*, and several other dying commodities, saying nothing of the duty upon *coals*.

I know that in time of need money must be raised: And in my quarto volume I think I did prove, that the more money was given to the King, the richer we must be; but I am strongly persuaded, that a revenue may be so raised, as to encrease rather than prejudice trade. And so much for *mather*.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, Jan. 20. 169⁸₉. NUM. CCCXXXIX.

Spurry described. Its use. Three sorts. A proposal. Encouragers of exotics here.

I N my last I discoursed upon *mather*, shewing what advantages it might be to us, if we could serve our own uses by planting it here:

The next in course is *spurry*, which is an herb that is *stellate*, so stiled from the manner of the growth of its leaves, which encompass the stalk at intervals, like the rays of a star, having the larger flowers growing on the top of the branches, having the narrower leaves, and the flower consisting of five leaves.

Mr. Worlidge from Mr. Hartlib's *Legacy* tells us, that in the *Low Countries* they usually sow it twice in a summer, the first in *May*; in *June* and *July* it will be in *flower*, and in *August* the seed is usually ripe.

The second time of sowing is after *rye-harvest*, which grounds they usually plough up, and sow it with *spurry seed*, that it may grow up and serve their kine till *New-years-day*. This pasture makes excellent butters, preferred by many before *May-butter*. Hens will greedily eat the herb, and it makes them lay the more eggs.

The dictionary says, that *spergula* is an herb, which for the property it hath to fat cattle, is called *franck* or *spurry*.

Mr. Ray in his large history of plants gives descriptions of *purple spurry*, *spurry*, and *sea spurry*, and says that *spurry* grows too frequent among corn, but nothing of the uses or culture of it.

A very ingenious gentleman has often told me, that the *Dutch*, when in winter they buy butter, do frequently agree that it shall be *spurry butter*.

All these things considered, I wonder, seeing *England* has been so much upon improvements, that I hear no more of this grass here; but whether the reason is, that our *turnips* prove a better winter food, or we are at contest who shall begin the trial, or 'tis difficult to get the seeds, or 'tis no body's business, or what else I know not. For my own part, tho' my will is good, yet my own purse will not improve all sorts of Husbandry; but had I a set of gentlemen that would bear the charges, there should hardly be a *tree*, *shrub*, or more tender *plant* in *England*, *Europe*, or perhaps a larger distance, that was likely to prove greatly useful to *England*, but those gentlemen should partake of; for why may we not as well as *flax-seed* from *Eastland*, *onion-seed* from *Strasbourgh*, *melon-seed* from *Italy*, and divers others, have *grafts*, *roots*, and *seeds* from *France*, *Spain*, *Italy*, or any other place we trade to in the world.

of HUSBANDRY and TRADE. 375

I do not say we improve not, for Mr. Petty-
ver, F. R. S. corresponds with all the famous
botanicks in the world he can meet with. The
old *East-India Company* made lately a present to
the *Royal Society*, a *hortus ficcus*, of seven books
of *Indian rare plants*; and the excellent botanist,
her grace the Dutchess of *Beaufort*, sent lately
one book of a *hortus ficcus* to Dr. *Sloan*, which
grew in her own garden from foreign seeds, that,
as I am informed, the like of most of which have
not been any where yet described.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, January 27. 169^s. NUM. CCCXL.

Rhubarb described. How much imported.
Its uses. From whence brought. 'Tis
planted here. Buck-wheat described. Its
culture in Surrey and Staffordshire.

I N my last I gave you an account of *spurry*:
Now for *rhubarb*, which is an herb of *stami-
nous* flowers, and not of grassy leaves, having a
triangular seed, *perennial* of the *bigger* kind; be-
ing the more *large great* leaf, and the root used
for *purging*.

Of this there was imported *anno* 1694, 1695,
from the *Streights* 328*l.* from *Spain* 11100*l.* in
all 11428*l.*

This is a root that is very much used in medi-
cine; and truly it deserves to be; for it is an

B b 4

excellent

376 *A COLLECTION for Improvement*

excellent *stomachick*, and purges gently if chewed in the mouth, as 'tis by many. It's mixed with other purgers in *infusion*, *powder*, *extract*, *apozem*, *syrup*, *pills*, and what not: And tho' 'tis an excellent purger, yet 'tis as brave a binder if boiled or much dried; and when mixed with some other proper medicines, as our *Physicians* now know how, it is a medicine that in several cases we can as well depend on, as we can on *Jesuits powder* for an *ague*, which seldom fails. It has of late been very scarce. I hunted many of the principal druggists shops, and can get but very little that is *superfine*, of which, if possible, I'll always have some.

Some talk of its coming from *China*, *Tartaria*, and *Russia*; but we have it chiefly from *Turkey*; and altho' some comes from *Russia*, yet I believe it only comes from *Turkey* or *Tartary*.

It being a thick root, very often 'tis not well dried, which makes it apt to grow rotten, notwithstanding 'tis dried by boring a hole thro' the middle, and putting in a twist like a cord; therefore 'tis commonly kept in dry baggs or boxes lined with woollen, or wrapped in cotton, that the moist air might be sucked into them, rather than the *rhbarb*.

Some have planted it here with hopes to cure it as in *Turkey*; but I cannot learn that 'tis brought to perfection; and whether it ever will, I know not: For *non omnia fert omne tellus*.

The next in course to *rhbarb* is *buckwheat*, or *brank*, which is an herb of a *staminious flower*, having leaves *triangular*, and *black seed*, which is *erect* and *esculent*.

Mr. *Worlidge* says, 'tis a grain exceeding advantageous on barren sandy lands. 'Tis much sown in *Surrey*; less than of any other grain sows an acre:

of HUSBANDRY and TRADE. 377

acre: It is usually sown as *barley*, but later: It is also late ripe, and yields a very great increase, and is excellent food for swine, poultry, &c. When mown, it must lie several days, till the stalks be withered before it be housed: There is no danger of the seed falling from it.

Dr. Plot in his history of *Staffordshire* tells us in Chap. 6. Parag. 15. p. 205. that an improper sort of wheat is sown in the barren hungry lands of this county, viz. *Ocymum cereale* sive *tragophyrum*, commonly called *buck-wheat*; not that it hath any likeness, either in the herbage or grain to any sort of *wheat*, but because, as he supposes, the seed serveth among the meaner sort for the same use for the making of bread.

It is sown either alone or mixed with other corn, viz. *barley*, and so made into bread and eaten; which, though less nourishing than *wheat*, *rye*, or *barley*, yet more than *millet* or *panick*, and that nourishment good: For the country people of divers places in *Germany* and *Italy* feed only upon this, and yet are strong and fit for the hardest labour. It digests easily, and fattens quickly, and especially *cattle* and *poultry*, which, if not speedily killed, after thus fatted, 'tis said they'll die of themselves suffocated with their own fat.

Yours,

JOHN HOUGHTON, F. R. S.

FRI-

FRIDAY, February 3. 169⁸/₂. NUM. CCCLXI.

Hemp and flax described. How much hemp and several things from it imported Anno 1698, 5.

IN my last I gave some account of *buck-wheat*, now in course comes *hemp*; which is an herb of *staminious flowers*, whose seeds are round and distinguishable by sex, of *male* and *female*; because from the same seed some plants are produced, which bear *flowers* and no *seeds*; and others which bear *seeds* and no *flowers*.

'Tis of the *bigger* sort, having a divided leaf, with a large hollow stalk, and a compound or fingered leaf, of the rind of which linen is made.

Flax will not come in course yet a great while; but because they make *linnen* of that also, and in some of the manufactures from them, 'twill be hard to distinguish which is which, I think it best to join them together.

Flax is a *capsulate herb*, bearing *flowers* of *five leaves*. The leaf is undivided, and 'tis considerable for its large flowers, and used for the making of fine *linen*, having long narrow leaves, and a round *seed-vessel*, containing oblong *shining seeds*.

There was imported *Anno 1694, 5.* of *hemp* from *Holland* C. 34. from *Dantzick* C. 79. from *Russia* C. 1123. from *Sweden* C. 70538. from *Germany* tuns 35. In all 71774 C. and 35 tuns. or 3573 tuns and 14 C.

Of *hemp seed* 15 casks from *Holland*.

Of

of HUSBANDRY and TRADE. 379

Of *bemp-seed oil*, from *Holland*, casks 50 hog-
heads 15. tun 1.

Of *spruce-yarn*, from *Dantzick* C. 735. L. 148.
from *Sweden* C. 507. from *Germany* C. 74. from
Holland C. 934, in all 2251 C. and 36 L. or 112
tuns, 11 C. and 36 L.

Of *cordage-yarn*, from *Sweden* C. 38. from
Germany C. 58 in all C. 96. or 4 tuns and 16 C.

Of *cable-yarn* from *Holland* C. 32.

Of *cordage*, from *Dantzick*, C. 86. from *Por-
tugal* C. 48 from *Sweden* C. 817. from *Holland*
L. 84. in all C. 950. or 47 tun and an half, and
84 L.

Of *twine*, from *Germany* C. 1. from *Holland*
C. 252. in all C. 253. or 12 tun and 13 C.

Of *pack-thread*, from *Holland* C. 1. L. 4770.
in all 43 C. and 66 L. or 2 tun, 3 C. and 66 L.

Of *lines*, from *Germany* 32 dozen.

Of *girthweb-rolls*. 12 from *Holland*

Of *packing-linen*, from *Holland* 300 ells.

Of *sail-cloth*, from *Dantzick* 1036 pieces:
from *Germany* 67 pieces: in all 1103 pieces.

Of *Holland duck* from *Germany* 11000 ells:
from *Holland* 397979 ells: in all 508979 ells.

Spruce-canvas, from *Sweden* ells 80.

Next Friday expect more from

Yours,

JOHN HOUGHTON, F.R.S.

FRI-

 FRIDAY, February 10. 169⁸/₉. NUM. CCCLXII.

How much linen of divers sorts were imported An. 1694, 5. and from whence.

IN my last I shewed you how much *hemp*, *hemp-seed*, *hemp-seed oil*, *spruce-yarn*, *cordage yarn*, *cable-yarn*, *cordage*, *twine*, *pack-thread*, *lines*, *girthweb*, *packing-linen*, *sail-cloth*, *holland-duck* and *spruce-canvas*, were imported Anno 1694, 5.

There were also imported of *canvas* from *Dantzick*, ells 729722, from *Germany* ells 8000, and from *Holland* ells 100: in all 737825 ells.

Of *hempen-rolls*, from *Dantzick* 8106 ells.

Of *hinderlands* from *Dantzick* 22800 ells, from *Sweden* 42900 ells, from *Germany* 88300 ells, from *Holland* 2042 ells, in all 156042 ells.

Of *poldavis* from *Dantzick* 260 bolts, from *Sweden* 2054 pieces.

Of *Muscovia linen* from *Dantzick* 8400 ells, from *Sweden* 43300 ells, in all 51700 ells.

Of *barras* from *Germany* 239437 ells.

Of *buckrams* 17936 in number.

Of *flax* there were imported from *Dantzick* C. 1. from *Sweden* C. 9049, from *Germany* C. 3, from *Holland* C. 826, and 17 C. of *snow-ting*, in all 9896 C. or 494 tun and 16 C.

Of *linseed-oil* from *Holland* hogsheds 40, casks 140, tuns 20.

Of *linen-yarn* from *Sweden* 1500 L. from *Germany* 72920 L. 8 bags, 9 sacks, and 1282 vats, from *Scotland* 8725 L. from *Holland* 11 vats,

of HUSBANDRY and TRADE. 381

4161 L. in all 87306 L. 8 bags, 9 sacks, and 1293 vats.

Of diaper-yarn 1380 C. from *Russia*.

Of *spinal* from *Germany* 50 L. from *Holland* 1701 L. in all 1751 L.

Of *incle* from *Germany* 9757 L. from *Holland* 115047 L. 1584 doz. and 498 doz. of wrought *incle*, in all 124704 L. beside the dozens.

Of *flais* and *frames* 960 from *Germany*.

Of *twist* 4231 doz. and 6 L. from *Holland*.

Of *purl* from *Holland* 94 dozen and 15 gros.

Of *edging* from *Holland* 30 dozen.

Of *brown thread* from *Sweden* 2 L. from *Germany* 9. L. in all 11 L.

Of *sisters-thread* from *Holland* 108038 L.

Of *bridges-thread*, from *Holland* 644 dozen.

Of *whited-brown thread* from *Holland* 3571 dozen, 198 L.

Of *tape cert*, twice, case 1, and 22707 dozen from *Holland*.

Of *tikes* from *Sweden* 1. from *Germany* 1960, and yards 139, from *Scotland* 1, and from *Holland* 674 pieces.

Of *fustian* from *Germany* 3 pieces.

Of cloth under the name *linen*, from *England*, (which I suppose was prize) 33499 ells, from *Dantzick* 624155 ells, from *Russia* 4450 ells, from *Portugal* 53 ells, from *Sweden* 252744 ells, from *Germany* 375216 ells, and 3916 pieces, from *Scotland* 510030 ells, from *Holland* 648929 ells, in all 2449076 ells and 3916 pieces.

Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRI-

FRIDAY, February 17. 169⁸. NUM. CCCXLIII.

A farther account of what linen was imported An. 1694, 5.

IN my two last I shewed how much was imported *Anno 1694, 5.* of *bemp, flax* and things made from thence. I must farther tell you there came

Of *heffens* from *Dantzick* 900 ells, from *Germany* 90605 ells, and 2 fats, from *Holland* 7400 ells, in all 98950 ells and 2 fats.

Of *Polonia linen* from *Dantzick* 184250 ells, and seven bags, from *Sweden* 17789 ells, from *Germany* 5496 ells, in all 207526 ells and seven bags.

Of *Germany linen* from *Dantzick* 8700 ells, from *Germany* 9749804 ells, from *Scotland* 24000 ells, from *Holland* 112050 ells, in all 9894554 ells.

Of *barfords* from *Germany* 79200 ells.

Of *ozonbrigs*, from *Germany* 757474 ells, from *Holland* 14819 ells, in all 772293 ells.

Of *checks* from *Germany* in number 44797, from *Holland* 996, in all 44793.

Of *minsters* from *Germany* 74246 ells.

Of *neckcloths* from *Germany* 1600 pieces, 22 dozen and 2 mixed with silk, from *Holland* 403 pieces, and 1085 *neckcloths*, in all 2003 pieces, 22 dozen, and 1087 *neckcloths*.

Of *handkerchiefs* from *Holland* in number 6198, and 2 pieces.

Of

of HUSBANDRY and TRADE. 383

Of *cambricks* from *Holland* in number 6280.

Of *lawns* from *Germany* in number 97065, from *Holland* 10494, and 226 pieces, in all 107559 *lawns*, and 226 pieces.

Of *tufted lawns* from *Holland* 40 pieces.

Of *tufted linen* from *Holland* 180 pieces.

Of *cloths printed* from *Holland* 6.

Of *diaper* from *Dantzick* eighty four yards and six pieces, from *Russia* 148 yards, from *Sweden* forty eight yards, from *Germany* 191673 yards, from *Scotland* 108 yards, from *Holland* 4443 yards, in all 196594 yards and six pieces.

Of *damask* from *England* (I suppose prize) 738 yards, from *Dantzick* twenty eight yards, from *Germany* 83639 yards, from *Holland* 3068 yards, in all 87473 yards.

Of *striped damask* from *Holland* 38 pieces.

Of *pictures* from *England* (I suppose prize) 75, from *Germ.* four, in all 79.

Of *paper* from the *Streights* 98754 reams, from *Germany* 39043 reams, from *Holland* 58717 reams and 100 bundles, in all 196494 reams and 100 bundles.

Of *paper printed* from *Holland* reams 2.

Of *prints*, from *Holland* certain thrice, and case 1.

Of *maps* from *England* (I suppose prize) bales seven, from *Holland* in number 28, bundle 1, reams eight, C. 1. certain thrice.

Of *sea-charts* from *Holland* parcels two.

Next Friday expect more from

Yours.

JOHN HOUGHTON, F. R. S.

FRI-

 FRIDAY, February 24. 169⁸/₉. NUM. CCCXLIV.

*A farther account of linen imported. A
general account.*

IN my three last I shewed how much was imported anno 1694, 5. of *hemp*, *flax*, and things made from thence. I must farther tell you there came

Of *globes* from *Holland*, in number 3.

Of *books* from *Germany* C. 6. from *Holland* C. 1218, in number 146. L. 163, and certain.

Of *books bound*, in number 32. Pack 1. and case 1.

Of *painted paper* from *Holland* 214 reams.

So there was imported in all, of *hemp* above 3573 tuns, of *hemp-seed* 15 casks, of *hemp-seed oil* I suppose about 17 tun, of *spruce-yarn* above 112 tun, of *cable-yarn*, *cordage-yarn*, and *cordage* about 54 tun, of *twine* almost 13 tun, of *pack-thread* above 2 tun, of *lines* 32 dozen, of *girth-web*, 12 rolls, of *packing linen* 300 ells, of *sail-cloth* 1103 pieces, of *Holland-duck* 508979 ells, of *spruce-canvas* 80 ells, of *canvas* 737825 ells, of *hempen rolls* 8106 ells, of *binderlands* 156042 ells, of *Poldavia* 260 bolts and 2054 pieces, of *Muscovia linen* 51700 ells, of *barras*, 239437 ells, and 17936 buckrams.

Of *flax* almost 495 tun, of *linseed-oil* I suppose 60 tun, of *linen-yarn* 87306 L. 8 bags, 9 sacks and 1293 fats of *diaper-yarn*, 1380 C. of *spinal* 1751 L. of *incle* 124704 L. and 1584 dozen, of *slais* and *frames* 960, of *twist* above 4231 dozen,

of HUSBANDRY and TRADE. 385

dozen, of *purl* 94 dozen and 15 gross, of *brown thread* 11 L. of *sisters thread* 108038 L. of *Bridges thread* 644 dozen, of *whited-brown-thread* 3571 dozen and 198 L. of *tape* certain twice, 1 case and 22707 dozen, of *tikes* 1962, 139 yards, and 674 pieces, of *fustian* 3 pieces, of *cloth* under the name of *linen* 2449076 ells and 3916 pieces, of *hessens* 98950 ells and 2 fats, of *Polonia-linen* 207536 ells and 2 fats, of *Germany-linen* 9894554 ells, of *Harfords* 7900 ells, of *ozenbrigs* 772293 ells, of *checks* 45793. of *minsters* 74246 ells, of *neckcloths* 2003 pieces; 22 dozen, and 1087 in number, of *handkerchiefs* 6198 and 2 pieces, of *cambricks* 6284 in number, of *lawns* 507559 in number, and 226 pieces, of *tufted lawns* 40 pieces, of *tufted linen* 180 pieces, of *printed cloths* 6, of *diaper* 196594 yards and 6 pieces, of *damask* 87473 yards, of *striped damask* 38 pieces, of *pictures* 79, of *paper* 196494 reams and 100 bundles, of *printed paper* 2 reams, of *prints* certain thrice, and one case, of *mapps* 7 bales, 28 in number, one bundle, eight reams, one C. and certain thrice, of *sea-charts* two parcels, of *globes* three, of *books* 146 in number, 1224 C. 163 L. and certain, of *books bound* 32 in number, one pack, and one case, of *painted paper* 214 reams.

Next Friday expect more from

Yours,

JOHN HOUGHTON, F. R. S.

 FRIDAY, *March 2.* 169^s. NUM. CCCXLV.

*How much hemp, flax, and manufactures
thence imported in one year, An. 1694, s.
the culture of hemp.*

IN my four last I gave an account of how much *hemp, flax, and manufactures* thence, were imported from every place abroad, *anno 1694, s.* and in my last the *total* of each particular sort.

Now follows the *gross* of all the sorts of things from all places, *viz.*

Hemp and flax 4068 tun, *hempseed* fifteen casks, *hempseed and linseed-oil* seventy seven tun, *hempen yarn* sixty six tun, *flaxen yarn* 241866 L. eight bags, nine sacks, and 1293 fats; *spinal, inkle, twist, purl, and edging* 126455 L. 5939 dozen and fifteen gross, *slais and frames* 966, *thread* of all sorts 108147 L. and 4235 dozen, *tape* certain twice, one case and 22707 dozen, *girthwel* twelve rolls, *pictures* seventy nine, *paper* of all sorts 196718 reams, 101 bundles, two cases, seven bales, one C. and certain eight times, *globes* three, *books* 1225 C. one pack, and 178 in number. *Linen* of all sorts 14207104 ells, 284106 yards, 189575 pieces, 160 bolts, four fats, and 1351 *neckcloths*.

This quantity was imported at *London* only, and the general trade of *England* is to it about four in fifteen, or something more than a third of what comes to *London*, as I have observed in
more

more than one general account, and as it is in general, so I suppose it may be in linen. Moreover, every hundred ells of most of the coarse linen is 120 ells, and so allowed at the custom-house.

Whether the *Lords* and *Commons* will think the getting so great a trade into this kingdom worth their consideration, I know not; although I believe it may be done without losing our *woollen manufacture*, or other *trade* that is worth speaking on.

Now for the manner how we may get this great trade here, and first for the culture of *hemp*.

The *Country Farm* compiled in *French* by *Charles Stephens* and *John Liebault*, doctors of physick, and translated by *Richard Surfleet*, practitioner in physick, and printed for *Bonham Norton* of *London* 1600.

This book, page 700, tells us, that *hemp* must be sown in fat and well dunged grounds, and watered with some little brook, or else in flat and moist countries, where much labour and ploughing hath been bestowed: for the fatter the ground is the thicker will the bark or filling be. It must be sown in *March*, and gathered when the seed is ripe, and afterwards dried in the sun, wind or smoak, and then laid in some water to be watered, that so the pilling may the more easily depart from the stalks, afterwards to be used in making of ropes and cloth.

Hempseed is good to make *bens* lay often in the depth of winter. Some with the coals of the thickest roots make *gunpowder*. The juice and decoction of the green herb causeth earth-worms to come forth; but I have been told salt water will do it better. They say there are two sorts;

and the *male* beareth the seed, but why that is not called the *female* I cannot see.

Mr. *Worlidge*, in his *Systema Agriculturae*, p. 40. says, *hemp* delights in the best land, warm and sandy, or a little gravelly, so it be rich and of a deep soil, cold clay, wet and moorish is not good.

It is good to destroy weeds on any land. The best seed is the brightest, that which will retain its colour and substance in rubbing, three bushels will sow an acre; the richer the land, the thicker it must be sown; from the beginning to the end of *April* is the time of sowing, according as the spring falls out, earlier or later, it must be carefully preserved from birds, which will destroy many of the seeds. Next *Friday* expect more from

Yours,

JOHN HOUGHTON, *F.R.S.*

FRIDAY, *March* 9. 169⁸/₉. NUM. CCCXLVI.

Hemp, its culture and time of ripening.

IN my last I gave some account of the culture of *hemp* from Mr. *Worlidge*. He farther says, the season for gathering of it is first about *Lammas*, when a good part of it will be ripe, that is, the lighter summer *hemp* that bears no seed, and is called the *finble hemp*, and the stalk grows white; and when it is ripe, it is most easily discernable, which is about that season to be pulled forth and dried and laid up for use, you must be cautious of breaking what you leave lest you spoil it: You must let the other grow till the seed be ripe, which will be about *Michaelmas*, or before; and this is usually called

called the *karle-hemp*. When you have gathered and bound it in bundles of a yard compass (statute-measure) you must stack it up, or house it till you thrash out the seed. An acre of hemp may be worth unwrought from five to eight pound, if wrought up, to ten, twelve, or more pounds. It is a great succour to the poor, the *hempen harvest* coming after other harvests, and in winter season, it affords employment to such as are not capable of better.

Mr. *Markham* in his *English House-wife*, p. 175. gives a more large account of *hemp*, and says, the fittest soil must be a rich mingled earth of *clay* and *sand*, or *clay* and *gravel* well tempered; and the best serveth best for the purpose; for the simple *clay* or *sand* are nothing so good. This best is called *red hazel ground*, being well ordered and manured; and of this a principal place to sow *hemp* on is in old stack-yards, or places wherein winter sheep and cattle are wont to lie.

Some will preserve the ends of corn lands, which butt upon grass, to sow *hemp* or *flax* on, and manure it well with sheep; for corn, where cattle are teathered, is commonly destroyed; but with this 'tis otherwise.

Now for the tillage or ordering of the ground, it must be at least thrice broke, except it be some very mellow and light mould, as *stack-yard* and usual *hemp-yards* be; and there twice is sufficient, viz. about the latter end of *February* and *April*, when you must sow it reasonably thick with sound and perfect seed, of which the smoothest, soundest, brightest and cleanest is best. You must lay it shallow in the earth, and cover it close, light, and with so fine a mould as you can possibly break with your harrows, clotting beetles or sleighting, and till it appears above ground, you

390 *A COLLECTION for Improvement*

must carefully rend it, especially an hour or two before sun rises and sets, from birds and vermin which will pick the seeds out.

You need not weed it, for it is swift of growth, rough and venomous to any thing that grows under, and will soon destroy all weeds.

When ripe, it must be pulled up by the *roots*, and the time is, when the leaves fall downward, or turn yellow at the tops; and this for the most part will be in *July*, and about *Mary Maudlin's* day, if it be for *cloth*. But for seed you must let the *principal buns* stand till the latter end of *August*, and sometimes to *Mid-September*; and then the seed being turned brown and hard, you may gather it; for if it stand longer, it will shed suddenly.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, *March* 16. 169⁸. NUM. CCCXLVII.

A farther management of hemp.

IN my last I shewed somewhat about the culture and pulling of *hemp*. Now for the *ripening* or *seasoning* of it.

As soon as you have pulled it, lay it flat and thin upon the ground for a night and day at the most; and then, as housewives call it, tye it up in *bais*, and set them upright till you can conveniently carry them to the water, which should be done as speedily as may be.

The best water for it is the running stream; but because it infecteth the water, and destroyeth the fish, it may be best to employ standing waters. In either of these waters, according to your quantity, knock square-wise four or six stakes that are strong; then lay the round baits or bundles of hemp down under water, the thick ends of one bundle one way, and the thick ends of another bundle another way; and so lay all your baits upon baits, and let the water cover them over: And then with over-layers of wood bound to the stakes, keep the hemp down close, especially at the four corners, and with great stones or other heavy rubbish laid between the wood to cover the hemp and keep it from stirring, let it continue in the water four days and nights, if a running water, but longer if a standing water; and then take one of the uppermost baits and wash it; and if in washing you see the leaf come off, you may be sure 'tis watered enough.

When so, remove all that covered it, and wash every bait by it self, and rub it exceeding clean, leaving not a leaf on it, nor filth in it; then set it upright on the dry earth, that the water may drop from it; which done, load it, carry it home, and in some open place rear it upright against hedges, walls, or such like, where it may have the full strength of the sun, and being thoroughly dried, house it.

This done, you must break the hemp in a brake of wood (which is an instrument commonly known) and break out the dry *bun* or *kexe* from the rind which covers it. Let this be done on a dry day, and it as dry as tinder, or else it will never break well: Therefore if the weather will not do it, dry it gently on your kiln with a soft fire; but with great care that you fire not the

house: As a sure way to prevent which, my author advises four stakes in the earth at least five foot high, and laying over them small over-layers of wood, with hurdles on them, on which to spread the *hemp*, and to rear some on three sides; then with straw, shavings, and light dry wood, to make a soft fire, and so dry it without danger.

As it is breaking, you must open and look into it, breaking the root-ends first; and when that bun is sufficiently crushed, or hangeth in very small shivers within the hemp, then 'tis broke enough, and the bait is called a strike. These you must lay together, and so house them, scoring or writing how many strikes you break up every day. Next *Friday* expect a farther account of the management of *hemp* from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, *March 23.* 169^s. NUM.CCCXLVIII.

A farther account of dressing hemp.

MY last was about ordering of *hemp*; and that it may break so much the better, you must have two several *brakes*, viz. an open and wide tooth'd or nick'd brake, and a close and streight tooth'd brake; the first being to crush the *bun*, and the latter to beat it forth.

This done, swingle it upon a *swingle-tree-block*, made of an half inch board about four foot above ground, and set on a strong foot or stalk that will
not

not easily move; and with a piece of wood called *swingle-tree-dagger*, in the shape and proportion of an old dagger, with a reasonable blunt edge, you shall beat out all the loose buns and shivers that hang in the hemp, opening and turning it from one end to the other, till no bun or shiver be perceived therein; and then strike a twist and fold in the midst, which is ever the thickest part of the strike; and then lay by till you have swingled all. The advantage of this doing is not only the beating out of the hard bun, but an opening and softening of the *teare*, whereby it is prepared ready for the market.

When you have swingled your hemp once, shake up the refuse, which you beat from the same, with the tops, knots, and half brack'd buns, which fall from the brake, and drying them, thrash them with flayles, and then mixing with the refuse, dress 'em well with threshing and shaking, till the buns be clean driven out; and then lay 'em in a safe dry place till used. These are called *swingle-tree-hurds*; and what comes from the hemp will make window-cloth and such coarse stuff.

Your hemp being swingled once over (which is sufficient for the market or ordinary sale) then for cloth swingle it again; and as the first did beat away the bun and soften the rind, so this shall break, divide and prepare it for the *heckle*: The hurds which are this second time beaten off, you shall save; for they being toasted in wool-cards will make a hempen *barden*.

After the second swingling, and having laid by the hurds, divide the strikes into dozens or half dozens, and make them up into great thick rolls; and then spitting them on long sticks set them in the chimney corner, till by gentle heats they

they be dried exceedingly; then lay as many as you can in a round trough made for the purpose; and with beetles beat them till they handle both without and within very soft and pliant, and taking them from the trough, open the roller, and divide the strikes as at first, and if any be not beaten enough, roll 'em up, and beat 'em as before.

It being thus twice swingled, dried, and beaten, bring it to the coarse *heckle*, which is open and well tooth'd; but mix the hurds of this heckling with those of the latter swingling, and 'twill make the cloth much better. Then heckle it the second time thro' a good straight heckle made purposely for hemp, and be sure to break it well thereon, and save the hurds by themselves, and the strikes by themselves. Next *Friday* expect more from

Yours

JOHN HOUGHTON, F. R. S.

FRIDAY, *March* 30. 1699. NUM. CCCXLIX.

*A farther account of the management of
hemp and flax.*

IN my last I gave a great deal of the method of dressing *hemp*, but if you will have an excellent piece of *hempen* cloth, then, as you have beat it before, and heckl'd it once over, you shall roll it up again, dry and beat it as before; then heckle it through a fine flaxen heckle, and the tow will make a principal *hemping*; but the *teare*,
a cloth

a cloth as pure as fine *housewife's* linen, which will wear and last strangely. Thus you see the utmost art in dressing of *hemp* for each several purpose in *cloth-making*, till it comes to the *spinning*.

Flax is to be managed just like *hemp*, except as follows. It being more tender than *hemp*, you must weed and trim it, till it gets above all the weeds, and then it will shift for its self.

Flax, which ripens a little after the *hemp*, you shall pull as soon as the seed turns brown, and bend the head to the earthward: For it will afterward ripen of it self, as the *bun* drieth.

Flax needs to lie in the water less than *hemp*; it will shed the leaf in three nights;

Whereas *hemp* may be carried to the water within a night or two after the pulling; *flax* must be reared up, dried and withered a week or more to ripen the seed; which done, you must take *ripple* combs and ripple the flax over, which is the beating or breaking from the stalk the round bells or bobs which contain the seed; which you must preserve in some dry vessel or place till spring, and then beat or thrash it for use; and when your flax is rippled, you must send it to the water as aforesaid.

To break *flax* you must take the straightest brake that is used for *hemp*, and afterwards one of purpose, much straighter and sharper: For the *bun* being more small, tough, and thin, must necessarily be broken into much less pieces.

Flax, after it hath been twice swingled, needeth neither more drying nor beating than *hemp* doth, but may be brought to the heckle like *hemp*, only the heckle must be much finer and straighter; and as you did, the first heckle being much the coarsest, holding the strike stiff in your hand,
break

break it very well upon the heckle; save the *burdes* to make fine *burden* cloth with, and the strike you may pass through a finer heckle, and with the hurdes you may make fine middling cloth, and with the teare the best linen.

To dress *flax* for fine holland or thread, take the flax handled as before shewn, and laying three strikes together, plat them in a plat of three, as hard and close together as possible, joining one to the end of another; and then begin another, till you have enough to make a rowl like your hemp-rowl, and so till you have enough. This done in a hemp trough, beat them soundly, rather more than the hemp; then unplat it, and divide every strike from the other; then heckle it through a finer heckle than it used, but do it with deliberation; which will make what it is heckled from it, look and feel like *cotton* or *Jersey wooll*, and will make a pure linen, and run at least two yards and an half to the pound; but the teare will make a perfect strong and most fine holland, running at least five yards in the pound. Next *Friday* expect more from

Yours,

JOHN HOUGHTON, F. R. S.

FRI-

FRIDAY, April 7. 1699. Num. CCCL.

Spinning. Impossible to have good cloth without even yarn. Bucking and rinsing.

IN my last I ended the management of *bemp* till it was fit to be *spun*; which must be on wheel or rock; but the wheel is the swifter way, and the rock maketh the finer thread, which can never be too small so it be even; for no other will make a durable cloth.

If you put out the teare to spin, weigh it when it goes and comes dry, and you shall never allow for waste above an ounce or ounce and half: Some spin by the pound, some by the lay, and some by the day: But as to price, countries differ.

Your yarn being spun on spindles, spools, or such like, you shall reel it upon reels hardly two foot long, having only two cross-bars, which are most easy and least troubled with ravelling, tying every lay of eighty threads with a lay band of a big twist; twenty of these lays are called a *slipping*, the yarn being very fine, otherwise less of both kinds: But if you spin by the lay, as at a pound a lay or so; then custom allowed to the reel, which was eight yards, all above 160 threads to every lay, and twenty five or thirty lays to a *slipping*, which ordinarily make about a pound. Thus you may proportion the price of any spinning: For if the best be thus, the second so, and the third so.

This done, scour your yarn in the *slipping*, laying it in luke-warm water three or four days,
each

each day wringing it out and changing the water; then rinse it at a well or brook till the water comes from it pure clean; otherwise the cloth will not be white. Then cover the bottom of a bucking-tub with very fine ashes of the ash-tree, and opening and spreading your slippings, lay them on those ashes, and cover them with ashes again; and so *stratum super stratum* one upon another, till all your yarn be laid in; then cover them with a bucking-cloth, and lay on it a peck or two (according to the bigness of your tub) of more ashes, and pour in warm water till the tub be full, and let it stand all night: Next morning (pulling it out) let the lee run out into another clean vessel; and as it wasteth, so fill up the tub with warm water from a kettle on the fire; and as it wasteth, fill it up with the lee that runs from the bucking-tub, ever observing to make the lee hotter and hotter till it boileth: Supply the tub and kettle thus, for at least four hours, which is called the driving of a buck of yarn.

This done, take off the bucking-cloth, and putting the yarn with the lee and ashes into large tubs or boles, labour the yarn as hot as you can bear your hand in it, a pretty while together: Then carry it to some clean scouring water, and rinse it clean from the ashes; then hang it upon poles in the air all day; and at night lay the slippings in water, and the next day hang them up again; and when any part dries, cast water on them, observing ever to turn that side outermost which whitens slowest; and thus do at least seven days; then put all the yarn into a bucking-tub without ashes, and cover it as before with a bucking-cloth, and lay thereon store of fresh ashes, and drive that buck as before with very strong

of HUSBANDRY and TRADE. 399

strong boiling lee for half a day or more; then ring it and manage it day and night as before for another week. Then wash it in fair water and dry it up. Next *Friday* expect more from

Yours,

JOHN HOUGHTON, F. R. S.

FRIDAY, *April* 14. 1699. NUM. CCCLI.

A farther account of managing linen yarn. Weaving, how managed. Huggerbeck, Diaper, Damask. A description of a loom and its attendants.

THERE are other ways of scouring and whitening yarn; but my author thinks this best; therefore I'll not trouble you with them.

Your yarn scoured and whitened, you shall wind it into balls of a reasonable bigness, without any thing at the bottom, lest you be deceived in weight.

Your yarn wound and weighed, carry it to the weavers, and cast up how many yards of cloth you think your *web* will make, and let the *warp* and *weft* be even. There be other observations in the warping of cloth, as, to number your *portuffles*, and how many go to a yard, to look to the closeness and filling of the sleie, which sometimes hold, and sometime fail, according to the art of the workman.

The next thing is to get it well wove, and for twenty ells of good linen cloth of ell wide, and about

about four shillings and six pence the ell, you must have fifteen or sixteen pound of good fine yarn, of an equal fineness.

The warp must be put into a twenty hundred *reed*, and through *sleies*, and shot with as much of the same yarn, and 'twill make very substantial cloth. But to make it finer, some will have a finer *woof*, which will make the *warp* lie smoother; but it is not so good for lasting, although the main strength lies in the *warp*.

To keep the *warp* smooth by allaying all the loose hairiness of the yarn, and to make it work well, it must be often rubb'd with paste made of flower and water; but for ordinary cloth they use yeast or barm: And thus is made a plain piece of linen cloth.

Huggerbeck, *diaper*, and *damask*, are all made with throwing the shuttle after the same way, only there are more treddles and draughts to pull up and down the *sleies*, that the shuttle may make more variety according to the design of the artists. For *diaper* they commonly use sixteen or twenty four treddles, for *damask* fifty treddles or more.

A *reed* is an instrument made of pieces of cane to keep the threads asunder. A *sleie* is an instrument made of packthread, and so joined that they can open it wider or narrower to put the threads through as if they were rings. These have a communication with the *treddles*, and the *treddles* are sticks for the weaver to set his feet on, that thereby he may raise up one, and let down another at pleasure, and so alternately, that he may shoot the shuttle through.

There are two great *rollers*, one to roll the warp on, which is behind, and another to roll the cloth on as 'tis wove, which is before the reed and canes.

The

of HUSBANDRY and TRADE. 401

The rest of the loom are *pillars* and a *frame* of wood to keep all these together.

The *shuttle* is commonly made of box-wood, wide in the middle and hollow, and sharp at both ends: the hollowness has a wire in it to put on quills, on which are wound yarn to supply the woof, having a hole with an iron or brass ring in it at one end for the yarn to go through, and the points are arm'd with some bits of iron or brass put in to make them durable and keep all tight and smooth.

*Next *Friday* expect more from

Yours,

JOHN HOUGHTON, F. R. S

FRIDAY, *April*. 21. 1699. NUM. CCCLII.

Whitening and calendring of linen. Thread-making.

IN my last was the history of *weaving* and some other things, relating to *linen* cloth; which done, in order to *whiten* it, you must first lay it to steep as you did your yarn, to fetch out the soil and other filth gathered from the weaver; then rinse it as you did your yarn; then buck it also in lee and ashes as before said, and rinse it, and having loopes fixed to the selvedge of the cloth, spread it upon the grass, and stake it down at the utmost length and breadth, and as fast as it dries, water it again; but take heed you wet it not too much, for fear you

D d

mildew

mildew or rot it: neither cast water on it till it be in a manner dry; and be sure weekly to turn it, first on one side, and then on the other; and at the end of the first week buck it as before, in lee and ashes; then rinse it again, spread it and water it as before: then, if it whitens apace, you need not give it any more bucks with the ashes and cloth mixed together, but use a couple of clean bucks (as was shewn in the yarn) for the next fortnight, and then being whitened enough, dry up the cloth and use it as occasion shall require: the best season for whitening is in *April* and *May*.

Some housewives scour and whiten their cloth with water and bran, and buck it with lee and green hemlock; but my author dislikes the practice.

To improve linen farther, the drapers get several sorts of their cloths *calendred*; by which means the threads are made to lie flatter and smoother, and to look with a gloss; but altho' this pleases the eye, yet I suppose it adds nothing to the goodness of the linen.

'Tis done by rolling the cloths upon great wooden rollers, and laying them under a great wooden box full of weighty materials, and so by help of a horse that box is pulled to and fro upon divers of these rollers.

Thus having shewn you the whole process of the husbandry of *bemp* and *flax*, and in managing of it till it is fit to spin, the spinning, reeling, washing and drying of the yarn, the weaving, whitening and calendring of linen: Now for *thread*, which is made with linen-yarn twisted in mills, after the same manner the throwsters manage the silk. Some is twisted hard and some soft, according to the uses it is designed for.

of HUSBANDRY and TRADE. 403

for. There is a great deal of care and art too, in the whitening of it: and, to make it please, they often give it a bluish cast with *indico*, as is done also to some linen, and a great deal of the nicety is to make it up neatly into skeins and bundles, which they sell more by the mark put upon the paper it is wrapt in, than it is by being opened and viewed by the buyer.

Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, April 28. 1699. NUM. CCCLIII.

Tapes and filleting much made now in Manchester. Engine looms destroyed. Cheap selling gets trade. Reasons for engine looms. Thread-laces, bone-lace. Laws against its importation. Flanders nettled, and prohibiting woollen manufacture.

BESIDE what is already said about *flax*, *bemp*, and their manufactures, with *linen-yarn* they make *tape* and *filleting*. These are woven as ribbons; and formerly we used to buy them abundantly from *Cologne* and *Holland*; but since *engine-looms* have been known, we make great quantities; and long since I have been informed that there has been above 1000 of these looms in *Manchester* only: *London* has a great many also; but I think they are chiefly employ-

ed about silk, and more valuable manufactures: What there are in other Places I know not; but without doubt they have their shares.

In the time of K. *Charles II.* there was a great cry against these looms, and the weavers made an insurrection, breaking and burning those looms; and a great many others vindicated them, thinking it would take away the employment of the poor. But is it not a plain case, that if others can sell cheaper than we, and of the same goodness, they will in a great measure serve us and the rest of the world? But if we can sell cheapest, we shall do so, and our excessive quantities will make us more than amends. These complainants see no further than just the weaving: they never consider the increase of labour in making those looms, and all other trades and employments in other matters relating to these manufactures. According to these mens principles we must pull down mills, and beat our corn in mortars, leave printing for writing, ploughs for digging, carts, horses and water-carriage for carrying burthens on mens shoulders, and a thousand more such like; which I presume these complainants will hardly agree to; and 'tis one of our great prejudices that we have not thousands of saw-mills and all other engines that should enable us to live well, yet sell as cheap as any other.

Thread laces they make with bobbings, and can weave 'em even round.

With thread they make the lace called *bone-lace*; because the thread is wound about with trotter bones, which are clean, white and heavy, and with twisting these various ways, they form divers sorts of laces. In room of these some use bobbings, which are long pieces of wood turn'd
and

and made alike serviceable. Abundance of this lace we were used to bring from *Flanders*: for altho' of long time it has been prohibited, yet being of small bulk, and much in fashion, it was still brought in, notwithstanding abundance of seizures: but in the last sessions of parliament was made a very severe act against it, which makes all that sell it run a great hazard of being undone: but none can so mine that others will not countermine: for I hear that some of our dealers have gotten their work-folks over hither to make some of their patterns exactly; and if they have a hundred such pieces to swear by, if they will mix 200 pieces made abroad with them, and will say they were all made here, who shall gainsay them? But perhaps time may teach us some engines or ways to underwork the *Flanderskins*, and then who shall get the trade from us?

But it nettles *Flanders*, and they have, or are prohibiting our woollen manufacture, which is our *Diana*: and I would have it encouraged greatly; but is not ten shillings gotten by lace as well as ten shillings gotten by wool? And will they serve the world before they sell cheaper than we?

Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON F. R. S

FRIDAY, May 5. 1699. NUM. CCCLIV.

Arguments why we shall not lose our woollen manufacture. A proposal to increase the woollen manufacture. Point-lace.

AS in my last, if *Flanders* should prohibit our woollen manufacture, shall not we then have the like encouragement to steal it in there custom-free, as they have to get several of their commodities in hither? *Flanders* is very often the seat of war, and will their sheep thrive then? The *French* are as industrious at it, as I believe they e'er will be, and yet we have not lost all our woollen manufacture, and never shall so long as we can keep any of our wool from being exported; which, I think, we may also do, if we'll make it as dear here as it will be there: (for profits make markets) and one way, it's probable, may do; that is to say, if we would lay an excise of a *groat* a pound on all the wooll in *England*, and draw back *six pence* the pound for all the woollen manufacture exported and made here, I do not doubt but the *groats* would do a great deal more than pay the *six-pences*, and all the charges attending it, and this will make our wooll (if foreigners get it) a *groat* a pound dearer to them than now: and for what we export, it will be as cheap to us as now. I mention *six-pence* for a *groat*, because a pound of fresh wooll will not make a pound of manufacture, when fit for exportation:

tion: if any object, that it will be but a small duty on some high-prized wooll, and an extreme one on other low-prized wool, I grant it; but a parliament can mend that by making the duties vary, as they shall see good reasons. I am not sensible of any proposal has been yet made that is so likely to keep our wooll to our selves; and if there be any reasons in this, why should we be afraid of gaining a linen manufacture among us, that may amount to two millions a year, or more; I do think we may endeavour to get any manufacture here, without troubling our selves about any trade that others can hinder us of.

Beside bone-lace, we use a great deal of point-lace, which is brought from *Venice*, and also from *Lorrain* and *France*; if this could be all made here, it would make a great employ for our females; which, if we could universally bring into work, it would almost double our manufacture: but it is objected, that the nuns, who have a settled maintenance another way, make these; therefore they will out-sell us. It is possible they may: but we have a great many women who have maintenances as well as they, that would be content to work only for spending money, or at least, to buy fine clothes. I have known some citizens widows, who having lived well, can hardly tell how to live without a maid, and can hardly afford that: wherefore they set their maids to spin for prevention of idleness, and to get a little, though it *were* but enough to pay them their own wages. These folk may as *well* make point as spin: but *we* have found ways to *weave* a great deal, and some make one part and some another, and others only put them together; I do not see but a little en-

couragement, and fashion may gain the trade.
Next *Friday* expect more from

Yours &c.

JOHN HOUGHTON, *E. R. S.*

FRIDAY, May 12. 1699. NUM. CCCLV.

Twine, &c. Whitening, dying, printing, maps, pictures, oil-cloth, buckrams, old sheets. Necessity is the mother of invention.

BESIDE *point* and other things already mentioned, I think 'twou'd do well if we could make all our twine, pack-thread, line, ropes and nets at home; although I must confess we do it much more than we were formerly wont, as I am credibly informed.

We also *whiten* a great deal of linen-cloth and yarn here; but abundance we bring in whitened to our hand; and 'tis pretended because our water will not do it; but those that will consult Dr. *Plot's Natural Histories* and others, that are written of waters in *England*, will find we have a great variety: and for my own part I rather believe it a want of art: wherefore we should use all the fair stratagems we can to gain the foreign artists hither: we see they get the dying of our woollens there; why should we not get the *whitening* of their linens here?

But beside *whitening*, we *dye* a great deal of linen, and some we use to import dyed; and truly

of HUSBANDRY and TRADE. 409

truly I have seen some so done, printed and glazed, that it has made extremely pretty hanging for rooms, and cheap too.

But of late we have printed a great deal, and made it look like tapestry, and what not: and though a great many, by joining in a company about it, have burnt their fingers, yet I see the trade goes on, and I believe is of very good use to the kingdom.

Among these may be reckoned the printing of maps upon handkerchiefs, and a great many such like, and also the painting of clothes for pictures.

Oil-cloth is something of a trade among us; but it is not of any great consumption, though of very good use for wrapping up divers commodities that otherwise may be subject to damage by water.

Buckrams, although in this our age they have been greatly encreased here, yet we bring in some still: for want of old, we make it greatly of new linen stiffned; but formerly we brought in abundance of old sheets to make it with; and a great many of those sheets were used to trade with to *Guinea*; and they are used not only for cheapness sake, but in divers cases, because they are more soft and smooth.

Without doubt if we can encrease our city, we shall encrease our trade: for where there are multitudes of people, there will be a great many in necessity or at leastwise streightned; and necessity is the mother of invention. I doubt not but ways may be shewn how to get most of the manufactures in *Europe* into *England*, and yet have a very great importation of goods.

Next *Friday* expect more from

Yours,

JOHN HOUGHTON, F. R. S.

FRI-

FRIDAY, May 19. 1699. NUM. CCCLVI.

History of paper. Painted paper. Cut paper. Paste-board. Playing cards.

TO carry on the history of *hemp* and *flax*, I am now come to *paper*, which is made of *linen raggs* beaten with great hammers in a water-mill to a pulp or pap; and by the addition of fresh water carried in little troughs continually among this pap, the soil is carried off till it becomes perfectly white. The water is raised into these troughs by the wheel of the mill.

Such a proportion of this pap is put into a tub of water, as will, when well stirr'd, make a sheet of paper of such a thickness as desired, by once dipping a square sieve made of wire into it; which when the water is well run through, they turn and lay the sheet on a felt, and so a sheet and a felt, a sheet and a felt, till they have enough for a press, and they press them. After this, and, I think, some drying, they dip them again into some size; and this management is the chief of the art. When they are thorough dry, they are made up into quires of twenty four or twenty five each; and twenty of these quires make a ream. The broken sheets are commonly put together, and two of the worst quires are placed on the out-sides of the ream, and called the *out-side quires*; these are wrapt in past boards and tied up for sale.

Of

of HUSBANDRY and TRADE. 411

Of paper, there are divers sorts finer and coarser, as also *brown* and *blue* paper, with divers that are *printed* for the hanging of rooms; and truly they are very pretty, and make the houses of the more ordinary people look neat. At *Ebisham* in *Surry* they call it *paper tapestry*; and if they be in all parts well pasted close to the wall or boards, they are very durable: and it ought to be encouraged, because 'tis introductory to other hangings.

A great deal of the finest of the writing paper is cut; and some cut and gilt on the edges; and the cuttings are sold to the *silk-stockin trimmers* to burn a little and a little, to singe off the loose hairs that are on them: others come to the mill again and are gathered by the rag-folk; and after making a great many separations of these raggs they are sold to several sorts of tradesmen, and several there be that have got estates out of them.

With some of the aforefaid pap is made paste-board no otherwise than paper, only much thicker; although the common way has been by pasting together several sheets of the coarser paper for the middle, and covering each side with a sheet of finer paper; which being well dried, serves to make paste-board boxes with, and with leather for the binding of books.

With a fine sort of this paste-board printed, they make playing cards; and 'tis no small trade that these make: but whether a high duty may hinder the exportation, I know not: but I strongly persuade my self that few, when they have a mind to play at cards, will forbear, because cards are a groat instead of three pence the pack.

Next *Friday* expect more from

Yours,

JONH HOUGHTON, F. R. S.

FRI-

 FRIDAY, May 26. 1699. NUM. CCCLVII.

Paper made from any thing of flax and hemp. Rags collected at London yearly. Their price. Linsey-woolsey. How rags are washed, fermented, cut, beaten. The mortars described, and how supplied.

IN my last I gave you an account of *paper* in general; since that I have met with my friend Mr. *Million*, who has given it me in particular, as follows:

Fine paper may be made of any thing from *flax* and *hemp*, dress'd clear from the bun; but it is chiefly made of linen rags.

He says that from the bills of mortality may be collected yearly 250 tun of linen rags fit to make the finest writing and printing paper, which makes about 500000 *l.* and is about five pounds to a house.

These rags about seventeen year since were sold for 3 *l.* 10 *s.* the tun; but now are worth 9 *l.* which amount to 2240 *l.* all spent in labour, and therefore at 10 *l.* the head, must employ 224 people all the while.

At the paper-mills they are again sorted to make the *grobins fine*, *grobins second*, and *grobins tres*; for among the rags will be some *linsey-woolsey*, which the dirt makes indiscoverable, till they are once washed.

The best way of washing is to put them in a puncheon with many holes in the bottom, and grates on the side with strong wires. In this the
rags

of HUSBANDRY and TRADE. 413

raggs must be often stirr'd that the dirt may run from them.

When washed enough, they are laid in heaps a yard every way, and covered close with old dry pieces of clean sackings, till they truly sweat and rot, which they call fermenting. There is a proper season for this sweating, which is performed in four or five days time; and if they be not taken in their time, they'll mildew, discolour, and never make good paper; nay, they'll take fire as wet hay will.

After this, they twist them in handfuls, and cut them with a sharp hook set fast in a frame, with the point upwards, and edge from you; and so it is drawn upwards, and cut piece by piece about half inch long, or as the fingers will allow. A Tobacco engine will not do, because there may be some pieces of the wood cut into it, which would spoil all.

This done, they prime or feed the mortars, which are made oval, yard by half yard, and about half yard deep, of the heart of oak right seasoned: At the bottom of each is an iron cast plate an inch and quarter thick; but it is about thirty inches long, and not above eight inches broad, and it is shaped inward, as if it was a mould for a salmon with head and tail rounded. On one side of this in the middle is a washing block groved in with five augure holes in it, and a piece of sieve hair fastened on the inside. This hinders the hammer touching it, or any thing to go out except filthy water

These mortars are supplied day and night by little troughs with water from a cistern, fed by buckets fixed to the several floats of the wheel so long as the wheel goes. In these mortars it is beat fit for a remove to the presses just by; and
they

414 *A COLLECTION for Improvement*

they take it with little pails, having iron hoops, out of any mortar, whose hammer they can stop whilst the other work. Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F.R.S.

FRIDAY, June 2. 1698. NUM. CCCLVIII.

First stuffs. Bins. How pap is managed. Iron moulds. Second stuff. Trial of its preparation. Pit mortar. Priming the fat. The mould. How they dip it for a sheet of paper. A post, what.

IN my last I told you how *rags* were managed till they had been once beaten and taken out of the mortars, which is called the *first stuff*.

From the mortars this first stuff is lodged in boxes of five foot high, made like the bins in corn-chandlers shops, with the bottom board a-slant, and a little separation of the front for the water to drein away.

When the pap of rags is in, they take away as many of the front-boards (all which run in groves) as are needful, and press the pap down hard with their hands the next day; and so putting on another board and more pap till the box is full.

This pap lies here mellowing a week, more or less, according to the weather.

In

of HUSBANDRY and TRADE. 415

In the whole work there must be no *iron-work*, where it can be thought it should grow rusty; for it would *iron-mould* the stuff, and spoil the paper.

After this, the stuff is again put into clean mortars, then beaten and removed into boxes as before, and called the *second stuff*; and so likewise the third time, which fits it for the pit-mortar, where 'tis again beaten till some mixed with fair water, and being brewed to and fro, appears as if it were flower and water without any clods to it.

Thus prepared, 'tis fit for the pit-mortar, which has flat hammers without nails. Into this by a trough runs water continually whilst they work at the fat; and the beating and water dissolves it perfectly, when 'tis carried into the fat, and more is brought from the boxes, and thus they do successively.

The fat is primed according to art, when the liquor has such a proportion of the pap, as by dipping a mould in it, it may take up so much as will be thick enough for the sheet of paper desired.

A mould is a square sieve made with brass-wire-cloth, and supported with little round sticks to keep the wire that it shall not sag down, but be perfectly horizontal; for if it should any ways sag, one part of the sheet of paper would be thicker than the other, and spoil all. This mould is about an inch deep.

They dip this mould with a deckle on, into the fat, and take it out again shakingly, that the water may run clear from the pap in the sieve, and then deliver it to the coucher, who couches it upon a felt laid on a plank, and lays another felt on it, and so successively a sheet and a felt,
a sheet

416 *A COLLECTION for Improvement*

a sheet and a felt, till the post containing six quire be made, and they will make of post-paper twenty posts in a day or more. A post is one pressing.

The coucher returns the mould to the maker, and the maker to the coucher successively. Next *Friday* expect more from

Yours,

JOHN HOUGHTON, *F R. S.*

FRIDAY, *June 9.* 1699. NUM. CCCLIX.

A farther account of paper-making. Sizing.

IN my last I gave some account of *paper-making*. Furthermore, when a post is made, either the maker or the coucher whistles, and four or five men come immediately; one whereof draws the posts under the presses with two little hooks; and the rest press them with great strength, till no water is left, which is done with two or three pulls and great celerity.

This done, 'tis pulled from the press and set on the right side by the laying stool: Then the layer takes of the first felt, returns it to the coucher, lays the first sheet on the laying-stool, and thus successively till the whole post be done, the sheets are laid one on the other in exact regularity.

After this, 'tis set by till towards the end of their day's work (which is about three or four of the clock in the afternoon; for they begin by

three or four in the morning) and then the whole day's work is press'd as before, and set exactly one on another that it looks like one solid Paste board. After two or three pulls, as before, it is taken out by the dry workman, and carried up into the loft, and hung six or seven sheets together upon lines fastened to a thing they call a *tribble*, each tribble containing thirty lines ten or twelve foot long. When this is dried it is taken down, laid on a three-footed stool, and there rubbed smooth with the hands, and after placed in heaps seven or eight foot high in a very dry place, where it so stands still sizing, which is done after the following manner:

At most seasons they make a shift, but (as best) in spring or fall they take a fine dry temperate day, on which they put into a copper about two barrels of water, and when it is just warm, they put into it sixty pounds weight of clean parchment or vellum shavings, and it is boiled till it comes to a perfect size. When the fire is drawn out, it is streined through a fine cloth, on which is strewed a due proportion of white vitriol and roch-allom finely powdered, into a tub about a foot deep.

Near to this tub is brought about four or five ream of the paper, and a full gage, or so much as can be taken up with the hands at a time, is dip'd into the size, being as hot as the hands can well bear it, and with a certain gentle quick management it is so ordered, that every sheet shall be sized, and then put regularly into the press, pressed, quickly moved into the drying loft, and hung sheet by sheet till dry. Some artists will hang two or three sheets together without inconvenience. But note, the direct rays of the sun

must not come nigh it till it is dry, for otherwise the size would be drawn out.

When it is thorough dry it is taken down, smoothed with the hands as before, heaped, pressed hard, and so it stands all night. Next *Friday* expect more from

Yours

JOHN HOUGHTON, F.R.S.

FRIDAY, June 16. 1698. NUM. CCCLX.

A farther account of paper-making. Paper may be made of divers things. Marbling of paper. Making of liquor and colours.

IN my last I gave you some account of *paper-making*, and shewed how dried and left in the press all night, the next morning 'tis taken out and carried into the store-house, where it is sorted, what's fit for inside quires by themselves, and the outside by themselves; and then it is pressed again, and so stands all night commonly, although an hour or two will serve turn.

In the morning it is carried into the store-house again, where it is told into quires, folded and laid by in heaps, and when there is a press full, it is pressed again, doubled for a while, and then it is made into reams fit for sale. They put two out-side quires to each ream.

The *wrappers* are made of the settlings of the fat.

Size may be made of common glew, and paper may be made of hay, turnips, parsnips, cole-

wort leaves, or any thing that is fibrous; nay, it may be made of white woollen rags, but it will not serve for writing, because of the hairiness.

The *Indians* make their paper of silk and cotton, and we might save a great many such rags to make such paper with here; and thus much for *paper-making*.

Some paper, when made, is improved by *marbling* after the following manner, as it has been given to the Royal Society by *John Evelyn, Esq;*

Prepare a trough of the shape and dimensions of the larger sheet of paper commonly marbled; it may be made of lead or wood well joined, pitched, or primed, so as to contain the liquor, let it be about four fingers deep.

The liquor as follows: Take a quarter of a pound of gum *tragacanth*; macerate it four or five days in fair water; then add ten or twelve quarts of water, till it be of an unctuous consistency, tho' somewhat thinner than oil; then strein it through a sieve or piece of clean linen into the trough.

The colours for blue: Take of indico as much as is sufficient; grind it with a competent quantity of white lead till the colour be to your liking.

For green: Take indico and auripigment, the one ground, and the other tempered. Mix, boil these with simple water only.

For yellow: Take auripigment bruised and tempered only, for it will not suffer grinding.

For red: take the common, or, which is best, the finest lake, ground with the raspings of *Brazil* wood, which has been prepared by boiling half a day at the least.

Into all these colours put a little ox gall, which is two or three days old; and if the colours dilute not themselves sufficiently, add more gall.

If on the contrary, they spread too much, you have been too liberal, and must correct it by mingling some of the same colour without gall, until it be to your mind. Next *Friday* expect more from

Yours,

JOHN HOUGHTON, *F.R.S.*

FRIDAY, *June 23.* 1699. NUM. CCCLXI.

*How to preserve gall. Marbling of paper.
To make the figures like serpents.*

IN my last I shewed how to prepare the liquors and colours for *marbled paper*; but I must tell you that to preserve the *gall* from corrupting (to which 'tis obnoxious) put half a handful of common salt into it, thus may you keep it a month or more, and the age does improve it.

The marbling. When the gum is well settled in the trough, extend a sheet of paper displayed upon it, plunging it very shallow into the liquor, and suddenly lifting it out again, being held streightened between both the hands for the more dexterous performance.

This is done to stir up and raise the subsiding gum towards the surface, and for the more universal impregnating of the liquor,

This

This done, having all your colours before you in ample gallipots upon the table, where also the trough is placed, dip a reasonable hard brush of hogs hair (such as painters use) into what colour you please; but the blue is commonly used first, and sprinkle it on the surface of the liquor. If the colour were rightly prepared, it will dilate it self well, then the red in the like manner; but all with several pencils.

After this the yellow; lastly the green; and if you will add white, you are only to sprinkle it over with a little fair water, mixed with a small quantity of the ox's gall.

When all the several colours are thus floating on the liquor, to give them that agreeable chattering, you must with a pointed stick and a sudden address stir the liquor and fluctuating colours, by drawing from one side of the trough to the other: Then with the comb taken by the head with both your hands, comb the surface of the liquor in the trough from one extreme to another, permitting only the teeth to enter: This must be performed with a gentle and uniform motion, and will make those undulations which you see in the marble papers.

The comb is made with a straight stick about the bigness of the little finger, and as long as amounts to the breadth of the trough, inserted with small pins (such as women use) at the distance of a quarter of an inch; but let the ends of the stick unpinn'd, extend a little beyond the dimension of the trough's breadth, for the better managing thereof when you are to comb the liquor.

But if you desire the colours to lie in any other fantastical posture, representing serpents or such like, it is effected with the above-mentioned small

pointed stick, drawing upon what you have before combed; but it must be done with a dexterous hand, and with a very shallow dip into the liquor, circling as if you would draw some flourish or text-letter. Next week I shall shew how to apply the paper.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, June 30. 1699. NUM. CCCLXII.

*A farther account of marbling paper.
Printing of paper hangings.*

IN my last I promised to shew how to apply the paper for *marbling*, which is as follows.

When the colours are all in the posture, as in my last, display and apply upon them a sheet of white paper; but to do this artist-like requires a sleight to be obtained by practice only; because the surfaces of both the liquor and the paper are equally in all parts to encounter, and then before they have time to soak through; (for there must but one superficies be applied to the colours) which will be in the space of two or three pulses (unless the paper be very thick) lift up the paper suddenly and with an even hand, and then spreading it a while upon a board, you may immediately hang it upon a line as the printers do to dry; which when it is sufficiently, polish with a marble slick stone or ivory knob.

Note, If in this applying the paper the colours shou'd sink to the bottom of the trough (as frequently

quently it happens) 'tis a sign that the liquor is not sufficiently imbued with the ox-gall.

Note also, that you must renew the sprinkling of your colours, and perform all the other ceremonies with the stick and comb at every application of a fresh paper; for every paper takes off all the colour from the liquor entirely.

Note, That the combing is commonly the last thing done before the application of the paper. Shell gold rendred very liquid and well diluted, may be also sprinkled among the rest; but it is very rarely, if at all, to be obtained among the marble papers of the shops.

The finer the comb is, and the closer the teeth, the more curious and minute will be your work.

One that is very dexterous at the applying of the paper may (when once it is dry) marble both sides.

The next in course is printing, which is said to be known in *China* and other eastern countries long before it was known in *Europe*: But their printing was cutting their letters upon blocks in whole pages or forms, as among us our wooden pictures are cut: And a great deal of paper is now a-days so printed to be pasted upon walls, to serve instead of hangings; and truly if all parts of the sheet be well and close pasted on, it is very pretty, clean, and will last with tolerable care a great while; but there are some other done by rolls in long sheets of thick paper made for the purpose, whose sheets are pasted together to be so long as the height of a room; and they are managed like woollen hangings; and there is a great variety with curious cuts which are cheap, and if kept from wet, very lasting. Next week expect more from

Yours

JOHN HOUGHTON, F. R. S.

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FRI-

 FRIDAY, July. 7. 1699. NUM. CCCLXIII.

*Age of printing. Dr. Wallis's account.
When it began at Oxford.*

IN my last I gave some account of the *China* printing with letters upon blocks; but printing with single letters cast in metal as with us in *Europe*, is an invention not three hundred years old; and yet there is like to be a perpetual quarrel whether the first invention was at *Harlem* in *Holland*, or *Mentz* in *Germany*.

The *Harlemers* plead, that *Lawrensz Jansz Koster* of *Harlem* was the first inventer of printing, *Anno* 1430. but that in the infancy of the invention he used only wooden blocks; but after some time he cut single letters in steel, which he sunk into copper *matrices*, and fitting them to iron *moulds*, cast single letters of metal in those *matrices*. They say also that his companion *John Guttenberg* stole his tools while he was at church, and with them went to *Mentz*, and set them to work, and promoted his claim to the first invention of this art before *Koster* did his.

They pretend some proofs which are imperfect; but *Guttenberg* is more generally accepted.

The learned Dr. *Wallis* of *Oxford*, a member of the *Royal Society*, upon diligent enquiry, says, that about 1460 the art of printing began to be invented and practised in *Germany*, whether first at *Mentz* or *Harlem* it is not agreed; but it seems those concerned, before it was brought

of HUSBANDRY and TRADE. 425

brought to perfection, upon disagreement, parted company; and some of them at *Harlem*, and some at *Mentz* pursued the design at the same time.

The book commonly reputed to be first printed, is *Tully's Offices*, of which there are copies extant (as a rarity) in many libraries; which in the close is said to be printed at *Mentz*, 1465. (So the copy in the *Bodleian* library) or 1466. (So that in the library of *Corpus Christi*.) The said doctor quotes some passages in the books.

At *Harlem* and some other places in *Holland* they pretend to have books printed somewhat ancients than this: but they are most of them, if not all, done by way of carving whole pages in wood.

The chief inventer at *Harlem* is said to be *Lawrensz Jansz Koster*.

After these two places it seems to be next practised at *Oxford*: for by the care and at the charge of K. *Henry* the sixth, and of *Thomas Bourchier* then archbishop of *Canterbury* (and Chancellor of the university of *Oxford*,) *Robert Turner*, master of the robes, and *William Caxton* a merchant of *London*, were for that purpose sent to *Harlem*, at the charges partly of the King, partly of the Archbishop, who then prevailed privately with one *Frederick Corseles*, an under-workman, for money to come hither, who did at *Oxford* set up printing before it was exercised any where else in *England*, or any other place except *Mentz* and *Harlem*.

Next Friday expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.
FRI-

FRIDAY, July 11. 1699. NUM. CCCLXIV.

First printing on paper at Oxford. When printing began at London. Officers belonging to printing. A master-printer's office.

FOR proof of the early *printing* at *Oxford*, there be several copies yet extant (as one in the *archives* of the university of *Oxford*, another in the *library* of Dr. *Tho. Barlow*, bishop of *Lincoln*) of a treatise of St. *Jerome*, or rather *Ruffinus*, upon the creed in a broad *octavo*, printed at *Oxford* Anno 1468; which is but three years later than *Tully's Offices* at *Mentz* in 1465, and was perhaps one of the first books printed on paper; (that of *Tully's* being on vellum) and there printing hath continu'd to this day.

Soon after, *William Caxton* (supposed the same that brought it to *Oxford*) promoted it to *London*; and, as *Baker's chronicle* (and some others) say, about 1471; but we find no copies of books there printed earlier than 1480; and then, or soon after, it was received in *Venice, Italy* and other places, as appears by books yet extant. Thus far Dr. *Wallis*.

There is a dispute by Mr. *Moxon* whether *typography* or printing be an art or science, which is nothing to my purpose; but the several divisions relating to printing are, 1. The master-printer. 2. The letter-cutter. 3. The letter-caster. 4. The letter-dresser. Each of these are called

called letter-founders, although few can perform all. 5. The compositor. 6. The Corrector. 7. The press-man. 8. The ink-maker: besides several other trades they take in to their assistance, as the smith, joyner, &c.

I shall begin with the office of a *master-printer*, who is to provide a house wherein to set his printing-house (which is *printers* language for *printing tools*) where he gets a room or rooms well lighted, and of capacity for his number of *presses* and *cases*, allowing for each press about seven foot square upon the floor; and for every frame of cases, which holds two pair of cases, *viz.* one *roman* and one *italic*, five foot and a half in length (for so much they contain) and four foot and a half in breadth, though they contain but two foot and nine inches: but then room will be left to pass freely between two frames.

If he should put his presses and cases in the same room (which is not customary in *England*) he places the cases so as the right-hand may be farthest from the light, and not shadow any of the letters the compositor shall pick up; and the presses so as the light may fall from a window right before the *form* and *tinpan*; and if he can, on the north side the room, that the press-men may be the less incommoded by the sun's heat; and also that they may the better see by the constancy of that light, to keep the whole heap of an equal colour.

He must also have an even horizontal floor, that the presses may stand firm with a steady roof and sides, that with braces the presses may be very steady.

Next week expect more from Yours
JOHN HOUGHTON, F. R. S.
FRI-

FRIDAY, July 21. 1699. NUM. CCCLXV.

*The master-printer's farther business. Names
of types or printing letters.*

THE *master printer* is also to take care that his printing room have a clear and lofty light, but not too high, lest the violence of winter freeze through the paper windows both paper and letter, and so stop the work.

Here being but two sides of the room yet used, he places the correcting stone against a good light, and as near as he can towards the middle of the room, that the *compositors* at each end may have equal access. Sometimes there are several correcting stones.

The *Lee* and *rincing* trough he places towards some corner where there is good light, and under them he causes a sink to convey away the water: but he, who can, will place them in another room to avoid the slabbering.

About the middle he places the *distributing-frame*, which may be in light enough, though at some distance from the window.

In some other empty place he causes so many nest-frames as will hold his cases out of present use, and the letter-boards, with forms set by on them, that both the cases and forms may the better be secur'd from running to *pye*.

Having thus contrived the offices, he furnishes it with *letters, presses, cases, chases, furniture, &c.* Of each of which in their order.

of HUSBANDRY and TRADE. 429

Of a letter. He provides a fount (properly a fund) of letters of all bodies: for most have all, except the two first, viz. *Pearl*, *Nonparel*, *Brevier*, *Long-primmer*, *Pica*, *English*, *Great-primmer*, *Double-pica*, *Two-lines English*, *Great-cannon*.

These are the bodies most of use in *England*. But the *Dutch* have several other bodies, but not worth naming, they being so like some of these: yet in *England* is sometimes used another body, viz. a *small-pica*, but it is so like the *pica*, that there is danger of their mixing, and spoiling the beauty of both founts.

These *bodies* are sometimes cast with a *Roman*, *Italica*, and sometimes an *English* face. He also provides some *bodies* with the *musick*, the *Greek*, the *Hebrew*, and the *Syriac* face.

Following are shewn the number of each *body* in one *foot*, whereby the sizes may be understood.

Pearl, 184. *Nonparel*, 150. *Brevier* 112. *Long-primmer*, 92. *Pica*, 75, *English* 66. *Great-primmer*, 50. *Double-pica*, 38. *Two-lines English*, 33. *Great-cannon*, 172 q.

His care in the choice of these letters are,

First, that the letter have a true shape; for which my author prefers those cut by *Christophel Van Djik* of *Amsterdam*; for they are made of exact mathematical regular figures.

Secondly, that they be cut deep, which will print clear the longer.

Thirdly, that they be deep sunk in the *matrices*, lest the bottom line of a page beard. He must see the beard also well cut off by the *funder*.

Fourthly, That they be cast upon good metal, that they may last the longer.

He provides quantities of each according as he foresees his use.

He also provides characters of *astronomical signs, planets, aspects, algebraical, physical and chymical characters, &c.* And these of several of the most used bodies.

Next week expect more from

Yours,

JOHN HOUGHTON, *F. R. S.*

FRIDAY, July 28. 1699. NUM. CCCLXVI.

The master-printer's farther Office.

THE *master-printer* also provides *flowers* to set over the head of a page at the beginning of a book; also *wooden borders* and *wooden letters* for the beginning of a *dedication, preface, section, &c.* but for want of good cutting, *capitals* cast in metal generally now serves.

He also provides *planish'd brass rules*, which are better than cast, and must be exactly letter high, and streight, which he tries by applying the face and foot to the surface of the *correcting stone*; and if light cannot be seen through, 'tis a sign 'tis well.

He examines whether the edge has all along an equal breadth and fit thickness.

Next, he provides *cases*, viz. an upper and a lower case; both which are of an equal length, breadth and depth, viz. two foot nine inches long, one foot four inches and an half broad, and

of HUSBANDRY and TRADE. 431

and about an inch and a quarter deep, beside the bottom board; but some are shallower and some deeper.

Long-primmer, and downwards, are accounted small; *English*, and upwards, great bodies.

The letters in a shallow *case* lie more visible to the last, being less shadowed by the sides of the *boxes*.

A deep *case* will hold a great many letters, that a *compositor* need not so often distribute. It is not so soon low (as *compositors* say when the *case* grows towards empty) and a *low case* is inconvenient; because the *case* standing shelving downward towards the *compositor*, the letters tend towards the hither side of the *case*, and are shadowed by the hither side of that *box* they lie in; therefore not so easily seen or ready to come at with the fingers as if they lay in the middle.

These *cases* are encompassed with a *frame* about three quarters of an inch broad, that the ends of the several partitions may be let into the substance of the *frame*; but the hithermost side of the *frame* is about half an inch higher than the others, that when either the *galley*, or another pair of *cases* are set on them, the bottom-edge of the *galley*, or of those *cases* may stop against that higher *frame*.

The upper and lower *case* have a thick partition about three quarters of an inch broad, dove-tailed into the middle of the upper and under rail of the *frame*. In this partition grooves are made on either side to receive the ends of those partitions, that divide the breadth of the *case*, and also to strengthen the whole *frame*: for the bottom board is as well nailed to this thick partition, as to the outer *frame* of the *case*.

But

432 *A COLLECTION for Improvement*

But the divisions for the several boxes of both *cases* differ, and the biggest boxes must be nearest the *compositor's* hand ; because all *English* copy runs most upon such and such sorts ; so that the boxes for those sorts ought to be most capacious. Next week expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, July 29. 1699. NUM. CCCLXVII.

The printer's farther care. A catalogue of the compositor's furniture. The life of W. J. Blaeu.

THE *printer's* care in the choice of the *cases*, mentioned in my last, is, that the wood be well seasoned, and all the parts made strong, and workman-like, that the partitions be full an *English* body thick.

I should also give an account of the *frames* to set the *cases* on, the *galley*, the *correcting-stone*, the *letter-boards*, and *paper-boards* ; the furniture, viz. *head-sticks*, *foot-sticks*, *side-sticks*, *gutter-sticks*, *riglets*, *scabbards*, and *quoins*, the *mallet*, *shoot-ing-stick*, and *dress-ing-block*, *composing-sticks*, *bod-kin*, and *chase*, which are implements only for the *compositor's* use : But the *printer* must provide *machines* and *tools* for the *press-man's* use also.

There is a new and an old fashion'd *press* : And the last, which is much the better, was invent-ed by *William Jansen Blaew* of *Amsterdam* ; a
man

man as well famous for good and great printing, as for his many *astronomical* and *geographical* exhibitions to the world. In his youth he was bred a joyner, and having learned his trade, betook himself (as *Dutchmen* do) to travel: And it happened to *Denmark*, when the noble *Tycho Brahe* was setting up his astronomical observatory, and in his service was entertained for the making his *mathematical instruments* to observe withal; where he shewed himself so intelligent and curious, that according to the general report of his personal acquaintance, all, or most of the *syderal* observations set forth in *Tycho's* name, he was intrusted to make, as well as the instruments.

Before these observations were publish'd, *Tycho* gave *Blaew* the copies which he brought to *Amsterdam*, and betook himself to the making of globes according thereto. The increase of his trade encouraged him to deal in *geographical maps* and books also, and grew so curious in *engraving*, that many of his best globes and maps were engraved by his own hands; and by his conversation in *printing* of books at other *printing-houses*, got such insight in this art, that he set up a printing-house of his own: And finding inconveniences in the press, he contrived a remedy to each, and fabricated nine of these new-fashion'd *presses*, set them all on a row in his printing-house, and called each press by the name of one of the *musés*.

I differ from my author, and think this history of this excellent man very pertinent to a history of *printing*.

The *press* is a machine consisting of many *members*: But I should tire the most sort of my readers, if I should describe them. I'll refer them

434 *A COLLECTION for Improvement*
to a printing-house, and my author Mr. *Moxon*,
and next week expect printing ink from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, Aug. 11. 1699. NUM. CCCLXVIII.

The manner of making Dutch varnish.

HAD the *master-printer* every thing good but *ink*, his work would not be lik'd. The *Dutch* have been more careful in this than we, as my author shews in many particulars: But I'll only give you the receipt and manner of making the *Dutch varnish*.

They provide a kettle or a cauldron like diet-pots, or such as coffee-men heat their liquor in, only without a cock, twice as big as will hold the oil, that it may not boil over on a sudden. This cauldron, which is best, hath a copper cover, with a handle to fit the mouth. This is set on a strong iron *tresfoot*, and fill'd half full of old *linseed oil*, the older the better, and hath a good fire made under it of sea-coal, charcoal, or pretty big chumps of wood, that will burn well without much flame: For if it should meet with the steam of the oil, not only it but the house may be fired.

Thus they let the oil heat till they think it is boiling hot; which to know, they stick a peel'd onion to the end of a stick, and put it into the
heating

heating oil. If it be quite, or almost boiling hot, the onion will put the oil into a fermentation; so that a scum will gather on the top, and rise by degrees, according to the degree of heat: But if the scum arises over fast, they take out the onion, and by degrees it will fall again. Sometimes they put half a pound, or rarely a pound of beaten *rosin* to every gallon of oil, and strew it in with an iron ladle or by handfuls; but do it so leisurely, that the first must be wholly dissolv'd, before they put in any more, or else the scum will arise too fast; and if it should boil over never so little, the whole body of oil will take fire immediately.

N. B. I presume if it should take fire, it may be put out by covering the top of the cauldron with any thing.

If the oil be hot enough to burn, they burn it so often, till it be hard enough, which sometimes is six, seven, eight, or more times.

To burn it, they take a long small stick, or double up half a sheet of paper, and light one end to set fire to the oil, it will presently take if hot enough, else they boil it longer.

To try if it be hard enough, they put the end of a stick into the oil, with which they take up a little, and drop it on a hard place to cool; and when so, if it draw stiff like strong *Turpentine*, it is hard enough; otherwise it must be more boil'd or burn'd.

When 'tis well boil'd, they throw in an ounce of *litharge* of silver to every four gallons of oil to clarify it, and boil it gently once again; and then take it off the fire to stand and cool; and when they can put their hand in, they strain it through a linen cloth, and with their hands wring all the varnish out into a leaded stone-pot or pan;

436 *A COLLECTION for Improvement*

and keeping it cover'd, set it by for their use. The longer it stands by the better, because it is less subject to turn yellow on the paper that is printed with it.

This, he says, is the *Dutch* way of making *varnish*; and the way the *English ink-makers* ought to use. Next week expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, Aug. 18. 1699. NUM. CCCLXIX.

Notes on the former paper. A tumult made by putting water into boiling oil, with the reason of it.

NOTE, first, That the *varnish* may be made without *burning* the oil, viz. only with well and long *boiling* it: For *burning* is but a violent way of *boiling*, to thicken it the sooner.

Secondly, That an *apple* or *crust* of *bread*, &c. stuck on the end of a stick instead of an *onion*, will also make the scum of the *oil* rise. For my author says, 'tis only the air contained in the pores of the *apple*, *crust*, or *onion*, &c. press'd or forced out by the violent heat of the *oil*, that raises the many bubbles on the top of the *oil*, and the connection of those bubbles are usually called a *scum*.

Thirdly, The *English ink-makers* that often make *ink*, and that in great quantities, because one man may serve all *England*, instead of setting
a caul-

a cauldron on a trefoot, build a furnace under a great cauldron, and trim it about so with brick, that it boils far sooner and more securely, because if the oil should chance to boil over, it cannot run into the fire, being fenced about with brick, and the stoking-hole lying far under the cauldron.

Fourthly, When for want of a cauldron, the *master-printer* makes *varnish* in a kettle, he provides a thick *canvas* big enough, when three or four double, to cover the kettle, and to hang half round the sides. This canvas (to make it more soluble) is wet in water, and that well rung out again, so that the canvas remains only moist. This is to cover the kettle when the oil is burning, and to stifle the flame when cause is: And should but a drop or two of water fall from the canvas into the oil when burning, it will so raise the *scum*, that it might endanger the working over the top.

The reason why water should make such a bustle when thrown into boiling oil, my author has hinted at above under the name of *air* from an onion, &c. perhaps as follows may be something plainer.

Water is a heavier body than oil, and so it naturally subsides: When it is at the bottom, the great heat rarifies it into bubbles, and so makes it much lighter, by which means it endeavours to get to the top, in order to fly into smoke; but the particles of the oil being clammy, stick together, and do as it were by their weight strive to strike the watery globules down, which without doubt they do as oft as the lower points of the oily globules fall perpendicularly on the upper points of the watery globules, but they arise again as soon as they get out of the road; and

when they meet fideling, they pass each other till the watery bubbles get almost to the top, and then by lifting some of the oily parts with them, they make that we call *froth* or *scum*; and when all the watery particles are evaporated, the oil grows quiet, and this great commotion is the cause of the noise.

Yours

JOHN HOUGHTON, F. R. S.

FRIDAY, Sept. 1. 1699. NUM. CCCLXXI.

An epitome of the thirteen volumes. A description of hops.

IN my first volume is the nature of *earth, water, air, and fire*, with their effects, and reason of many of their operations: In my second, *natural history*, with the *taxes, acres, houses, &c.* in each county of *England and Wales*, with notes, particularly of *Yorkshire and Derbyshire*: In my third, the doctrine of *fermentation*, history of *cyder and clay*: In my fourth, a continuation of *clay*, and all its uses I could learn, with the history of *wheat*: In my fifth, the history of *joint-stocks and kine*: In my sixth I went on about *kine*, shewing the use and manufacture of most parts, the doctrine of *nutrition, circulation* of the blood, with reasons of its ascent, and manner of growing of *bones* and other parts: In my seventh I have carried on the history of *kine* in discourses upon *blood, butter, cheese, cows, cream, dung, milk,*

milk, urine, whey, and other particulars: In my eighth is an account of the ships that came from abroad to *London* from *New-years-day* 1694, to the same day 1695, with the number from each Prince's territories, and of all the goods imported that year, mentioned in the bills of entry, with the quantities from each place, and all together.

Upon these I have made some notes *natural* and *political*, as the advantages of a *coalition* with *Scotland*, the true case of a *free-trade*, a *regulated company*, and a *joint-stock*, with an easy and certain method for mending the roads, &c. In my ninth, are histories of imported *stone, glass, salt*, and a farther account of roads. In my tenth, a farther account of *salt*, the history of *nitre, gunpowder*, profits of the *Indian* trade, history of *vitriol, copperas, brimstone, okre, jett, and coal*. In my eleventh are the farther histories of *coal*; also of *arsenick, lapis hæmatites*, and the seven metals, with a description of all things I could learn were made from them, with some discourses about *air, alkali, colours, exchange, fire*, the manner of fluxing with *mercury*; *money, poison, trade, pumps, and wood*. In my twelfth I have given a division of *plants*, the histories of *mushrooms, wheat, rye, barley, oats, canes, and sugar*, with all the historical and political notes relating to them I could think proper, as the *quantum* of *beer* and *ale* that paid excise in divers years, the quantity of *malt* brought from *Ware* by water in a year, with a discourse about navigable rivers, and making them so; the difference about water and land-carriage, with the quantities of *sugar*, and the other things imported. In my thirteenth I have given the history of *saffron, onions, tuberoze, asarum, ros solis, gentian, aloe*, with the

manner of embalming and managing the dead in many countries: The history of *kelp*, *madder*, *spurry*, *rhabarb*, *buck-wheat*, *hemp* and *flax*: As also the history of *linen*, *thread*, *tape*, *lace*, *twine*, *dyeing*, *printing*, *maps*, *pictures*, *oil-cloth*, *buck-rams*, *paste-board*, *playing-cards*, *rags*, *paper-hangings*, the *printer's office*, with the life of *Blaew*, &c. In this fourteenth I shall give you the history of *hops*, and other things that have been imported, and go on as well as I can, endeavouring to make it the best account of *trade*, upon the best and most sure foot that ever has been yet published, and I could hear of: And all this I have applied, and will apply for the benefit of my country, not doubting but it may be made the richest and happiest the sun sees.

Yours

JOHN HOUGHTON, F. R. S.

FRIDAY, Sept. 8. 1699. NUM. CCCLXXII.

Hops described. The land it delights in. Shelter. To improve the land. Its culture.

IN my last I gave you an epitome of my thirteen volumes; and in the last volume ended the history of *flax* and *hemp*. Now in course comes *hops*, which is an herb of *staminious* flowers, and not of *grassy* leaves, whose seeds are round, distinguishable by sex, of male and female; because from the same seed some plants are produced

of HUSBANDRY *and* TRADE. 441

duced which bear flowers and no seeds, and others which bear seeds and no flowers.

It is of the bigger sort, having a divided leaf, being a *climbing plant*, twisting about such things as are next to it, from the right hand towards the left, contrary to the manner of other twining plants, of a *rough roundish leaf*, divided into many segments, with a head of *scaly tufts* growing in a cluster or bunch, commonly used to preserve drink from *souring*.

The hop is very much used in *England*, and very subject to damage by change of weather: Wherefore I think we ought to wish it the more produced. In order to it, Mr. *Worlidge* tells us it delights in the richest land, a deep mould, and light; if mix'd with sand it's the better: A black garden mould is excellent.

To lie near the water, when it may be laid dry, and a low mellow deep ground inclining southward, and defended by hills or trees from north and east, that it may lie warm, is best; but any ground may do, except stony and stiff clay.

In defect of natural shelter, the *ash* on a dry, and the *poplar* or *aspen* on a moist ground, are preferable for their quick growth. A thick *white-thorn* hedge is good, but not the *elm*; because, as some say, it contracteth mildews.

If the land be cold, stiff, sour, or barren, burn it at the latter end of the summer. Some sow turneps, hemp, or beans, to mellow and lighten the ground, and destroy the weeds.

Whatever it be, till it in the beginning of winter with plough or spade, making it even, and marking out the places where the hills must be, which is best done by a streightened line over-thwart the ground, with knots or threads tied at the distance you intend the hills.

442 *A COLLECTION for Improvement*

Some plant *chequer-wise*, which is best, if you would plough between the hills: Others plant in the *quicunx* form, which is most beautiful and better for the *hop*; and in a small ground, where you must use a *breast-plough* or *spade*: In either pitch a stick where each hill is to be; and if the ground be cold or stiff, lay on it the best mould, or dung and earth mixed; and at every stick dig a hole about a foot square, and fill it with the mould or compost, and there set your *plants*, which will repay your charge and trouble.

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, Sept. 15. 1699. NUM. CCCLXXIII.

How hops are cultivated.

THE *hops* in a dry ground are *planted* about six foot distant; in deep, moist, rich ground, subject to bear large hops, eight or nine foot is most convenient, and so plant according to the goodness of the soil.

But if the hills are over-distant, increase the roots in each hill, and so you'll apply more poles, and *è contra*.

A great many plant in the end of *March* or in *April*; but some affirm it best in *October*: for so the hops will settle against the spring.

Get the largest *setts* from a garden well kept, and where the hills have been raised very high the preceding year, which will encrease the plants
in

of HUSBANDRY and TRADE. 443

in number and bulk. Let the plants be eight or ten inches long, and in each three or four joints or buds.

Dig the holes eight, ten, or twelve inches deep, and about a foot over, before you take the setts out of the ground, else you must lay them in cold and moist earth, and take them out as you have occasion.

Some set two or three plants upright in the middle of the hole, and hold them hard together with one hand, while they fill the hole with the other with fine mould, made ready before-hand, observing to set the tops even with the surface of the ground, and the same end uppermost that grew so before; and then fasten well the earth about the roots.

Others plant one at each corner of the hole, which my author most likes.

'Tis good to raise the earth two or three inches above the sett, unless you plant so late that the green sprigs are shot forth; then a total covering will destroy them.

Beware of wild hops, which are only discerned by the stalk and fruit.

If the hops be worn out of heart, then about the beginning of winter dig them, and take away the old barren earth, and apply good fat mould or compost to their roots; be sure this be done before *February*, in open weather; for such winter dressing will renovate the hop, and destroy the weeds.

But for hearty strong hops, late dressing is most proper, *viz.* in *March* or beginning of *April*. This will keep them from too early springing, which brings many injuries.

In dressing hops, pull down the hills and undermine round, till you come near the principal roots,

444 *A COLLECTION for Improvement*

roots, and then take the upper or younger roots in your hand, shaking off the earth, which earth being removed with your tool, you shall discern where the new roots grow out of the old setts, which setts you must be careful not to spoil. You need not mind the other roots, which must be cut away, except such as you mean to set.

Uncover only the tops of the old setts in the first year of cutting, and at what time soever you cut down your hills, cut not the roots before *March*.

Next *Friday* expect more from

Yours

JOHN HOUGHTON, F. R. S.

FRIDAY, *Sept.* 22. 1699. NUM. CCCLXXIV.

A farther account of cultivating of hops.

IN my last I gave some account of the cultivating of *hops*: furthermore,

At the first dressing, cut away all such roots or sprigs as grew the year before, out of your setts, within one inch of the same. Our ancient authors say, they must be cut close like *osiers*: but my author says, experience teaches 'tis good for a weak hop to leave some principal new shoots at the dressing, and that clean cutting hath very much damaged a hop-garden.

Cut not the roots that grow downward, but such as grow sideward, lest they incumber the ground.

of HUSBANDRY and TRADE. 445

The old roots are red; the last year's white. If there be any wild hops, take up the whole hill, and new plant it, marking it with a stick at the hop-harvest to prevent mistakes.

When you have dressed the roots, then apply your rich mould or compost prepared for that purpose, and make the hill not too high at first, lest you hinder the young shoots: when you dress, you may cut the hops, tho' they be sprung out of the hills. Be sure to keep poultry from the hop-garden.

Provide poles enough according to the distance of the hills, and according to the strength of the hop, the length or bigness.

If the hills be far distant, set four or five to each, otherwise two or three.

In hot, dry and hungry ground the poles may stand thicker than otherwise.

If the hops be strong and ground rich, get large poles; if otherwise, the contrary; for the hop will run out of heart if over-pole'd: but be sure not to over-pole the first year, although they require as many poles (or rather rods) the first, as any other year.

Alder-poles are esteemed the best, by reason of streightness and tapering form and rough rind, which suffers not the hop easily to slip down.

The *ash* is most lasting, especially if they grow on barren lands; some last ten or twelve years.

Forked poles bear the greatest burden.

Lay the poles between the hills before you begin to set them in the ground.

Pole when you see the hops above ground, and continue till they are a yard high; but set the largest pole to the strongest branches.

Set the pole so deep, that it may rather break than arise out of the ground by winds.

Let

446 *A COLLECTION for Improvement*

Let the poles lean outward one from the other, and stand equidistant at the top to prevent houseling, or growing too near each other, which will make shade, and cause more *baum* than *hops*; and leaning poles bear most *hops*.

Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, Sept. 29. 1699. NUM. CCCLXXV.

A farther account of cultivating of hops.

FARTHER of *hops*. Be sure to preserve a parcel of the worst poles, in case a pole should break or be over-burden'd: for if they lie on the ground, they soon perish.

Ram the earth on the out-side of the pole, to secure it from winds.

If the *hop* be under or over-poled, you may unwind it and place another in its stead, having some one to hold the *hop*, whilst you pitch in the pole; or you may place another near, and bring the *hop* to it.

When the *hops* are two or three foot out of the ground, wind them on the nearest poles, or such as have fewest hops, or at least place them to the pole, that they may wind with the course of the sun, and bind them gently thereto with some wither'd rush or woollen yarn; two or three strings are enough to a pole.

'Tis best doing this when the warmth of the day

of HUSBANDRY and TRADE. 447

day hath toughned the shoots; in the morning 'tis more dangerous.

During *April* and *May* the hops must be daily directed, lest they break themselves by going amiss.

A forked wand, a stool or a ladder, with a stay on the back, are convenient in order to direct the hops to the poler.

About *mid-summer* the hop begins to leave running at length, and to branch; therefore such as reach not to the top of the poles, 'twould do well to nip off the top, that it may branch the better, which is better than their growing in length.

To make up the hills, after rain in *May*, pare the surface with a spade or hough, or run it over with a plough; and with these parings raise your hills in height, burying and suppressing all superfluous shoots of hops and weeds. Thus will you hinder the droughts in summer to injure them, and the hops will send forth their roots to the surface of the earth, and thereby they imbibe what moisture shall happen.

This work may be continu'd throughout the summer, but more especially after a rain.

Be sure to keep your ground in good heart, and in a dry spring water your hops before you raise your hills. In hot and dry grounds a dry spring checks the hop in its first springing.

Use what water you can get, but what is gotten in a pond made with clay, at the lower end of your ground, is best.

In the midst of each hill thrust some pointed stick or iron down the middle, and pour in your water by degrees, till the hill is well soaked: then cover the hill with the parings of your garden. In a dry summer give each hill a pail-
full

full of water two or three times. Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, *Octob.* 6. 1699. NUM. CCCLXXVI.

A farther account of cultivating of hops.

IN my last I gave some account of watering *hops*. Farther, after every watering, make up the hills with the parings, weeds, the coolest and moistest materials you can get: for the more the root is shaded, the better it thrives; for a great many fare well that have natural shelter, and are never dreit.

Without this great pains little is to be gotten; but with such *elbow-grease*, my author says, one or two acres of *hop-ground* will yield more profit than fifty acres of arable.

Towards the end of *July* hops *blow*, and a week or fortnight after they *bell*, and in forward years are ripe the latter end of *August*.

When the hop or its seed turns a little brownish; or when they are easily pulled to pieces, and smell fragrantly, conclude them ripe, and gather them with many hands, before they shatter: for a wind may do great damage.

The way of gathering is to take down four hills in the midst of the garden: cut the roots, level the earth, throw water on it, tread and sweep it, so shall it be a fair floor to lay the hops on for picking.

On

of HUSBANDRY and TRADE. 449

On the out-side of this floor the pickers sit and pick the hops into baskets, the hops being stript from the poles, and brought to the floor.

Clear your floor twice or thrice in a day, and sweep it clean.

This way is best for streight poles.

Some pick them sitting dispersedly.

But the best way is to fasten a hair-cloth or blanket on a frame made of short poles, and set on four stakes, on which lay the poles with the hops on them, and pick them into the blanket; when 'tis full, remove them, and so *toties quoties*. You may remove this frame as occasion serves.

This way saves stripping the hops from the poles, and no scraggy poles hinder this picking, neither are any scattered by stripping, and they are all in sight, and sooner pick'd.

Before you draw your poles, with a sharp hook on a pole divide the hops where they grow on two poles, and cut them two or three foot above the hills, else the hop will bleed much of his strength away, which much weakens the hop.

This done, draw your poles; but if they are over fast in, draw them with an iron pair of toothed tongs, or a wooden leaver forked, on which are fixed two toothed irons; either of these laid over a block leaver-like, will easily raise them.

Draw no more at a time than what will serve for an hour or two, in case of very hot weather, or likelihood of rain.

Next *Friday* expect more from

Yours,

JOHN HOUGHTON, F. R. S.
G g FRI-

FRIDAY, *Octob.* 13. 1699. NUM. CCCLXXVI.

A farther account of cultivating of hops.

IN a large *hop-garden*, 'tis worth while to raise in the midst thereof a shed, under which you may pick your hops; which will defend both the hops and the pickers from the sun and storms. Here also may be laid hops unpick'd over night, to be pick'd in the morning, before the dew be off the other, and the poles may lie here dry in winter.

Gather no hops wet; but if dew or wet be on them, shake the poles, and they'll dry the sooner.

Let not your hops be over-ripe, lest they shed their seed (in which the chief strength consisteth) and lose their green colour, to the prejudice of their value, tho' some let them stand as long as they can, because they waste less in drying. Four pounds of green hops thorough ripe will make one pound of dry, and five pounds in their prime will make one: so they think they get more in the weight than they lose in the colour.

In picking, keep them clean from leaves and stalks, which will spoil their sale.

As fast as you pick dry them, otherwise they'll change colour: but if you must keep them, spread them on some floor, not too thick, and so the damage in a day or two will not be great.

Ill dry'd hops are naught, and will spoil all they come nigh.

To

of HUSBANDRY and TRADE. 451

To dry hops, the *Flemings* make a kiln of brick or stone, eight or ten foot wide, with a door-place on one side.

The fire place is made on the floor in the midst, about thirteen inches wide within, and thirty inches high, and to reach from the mouth to the back part, except room for a man to go round it. This is usually called a horse, and 'tis made in malt kilns.

The sides and end have holes for the fire to go out.

About five foot high is plac'd the bed or floor, whereon the hops must lie to be dried, which must have a wall about it four foot high to keep them from falling. At one side must be a windore to shove the dry'd hops into the room prepar'd for them.

The bed is made of even rails an inch square laid a quarter of an inch asunder, with a cross beam to support them in the middle, into the top of which the rails must be laid in, so that all may be smooth.

On this bed without an oost-cloth lay your hops by baskets full, beginning at one end, and so on, till all be cover'd about half a yard thick, without treading on them; lay them with a rake, so that they may be all of a thickness. Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F.R.S.

FRIDAY, Octob. 20. 1699. NUM. CCCLXXVIII.

A farther account of drying of hops.

TO dry your *hops*, make your fire of *broken poles* say some: but *charcoal* is the only fewel which will not prejudice the colour as smoaky wood will.

Keep your fire at a constant heat.

The hops this way must not be stirr'd, till thorough dry, which is, when the top is dry as the bottom; but if any be not so dry as the rest (which may be known by their ratling, if you try with a stick in several places) then abate them there, and dispose of them where the places were first dry.

When they are all dry through, which is known by the brittleness of the inner stalk, if rubbed, and it breaks short: Then take out the fire, and shove out the hops at the windore for that purpose, with a cole-rake made with a board at the end of a pole, into the room made to receive them; then go in at the door below, and sweep together the seeds and hops that fell through, and lay them with the other.

This done, lay another bed of green hops, and so *toties quoties*.

In several places they dry their hops on the ordinary *malt-kilns* on a hair cloth, about six inches thick; and when they are almost dry, with a scoop made for that purpose, they turn them upside down, and let them lie till every hop be thoroughly dried; and then with a hair-cloth

cloth remove them to the heap, where they are to lie till pickt.

Both these ways are subject to inconveniences. In the first, the hops lying so thick and never turned, those under must needs be overdry before the upper can be dry enough, and prejudice them both in strength and weight, besides the waste of firing, which must be long continued, to thorough dry so many together.

In the second way, the turning of the hops breaks them very much, by forcing the scoop against the rough hair-cloth, frets and spoils many hops, and shatters their seeds, else this way is rather to be preferr'd.

But the several inconveniences may be prevented by making the lower part of the kiln, as before describ'd, and the bed after the following manner: first, make a bed of flat ledges about an inch thick, and two or three inches broad sawn and laid across on the other chequer wise, the flat way, the distances about three or four inches: the ledges so entred the one into the other, that the floor may be even and smooth: this bed may rest on two or three joists set edge-wise to support it from sinking.

Cover this with double tin plates solder'd together at the joynts, and so order it that the joynts of the tin may lie over the middle of a ledge: when the board is wholly covered, fit boards about the edges of the kiln to keep up the hops, only let one side be to remove, that the hops may be shov'd off. Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F.R.S.

FRIDAY, *Octob.* 27. 1699. NUM. CCCLXXIX.

*Drying of hops, bagging them. Preserving
of the hop-poles.*

ON the *tin-floor* mentioned in my last, may the hops be turned without hazard or loss, as before on the hair, and with less expence of fuel: also any fuel will serve: for the smoak cannot pass through the hops; but be sure to have conveyances for it at the corners and sides of your kiln.

The fuel you'll save will in a little time recompence your charge.

To turn hops is troublesome; but a wooden cover lined with tin, to pull up and down, and to hand sometimes about a foot over, will, like a reverberatory furnace, dry the upper parts: and this, my author says, is the best way to dry hops, which is the most hazardous piece of work that belongs to them.

This done, you must lay them in some room for three weeks or a month, that they may cool, give, toughen; for if bagg'd from the kiln, they'll crumble to powder; but if they lie close cover'd with blankets, you may pack or bag them with more security.

The manner of *bagging* is thus: make a hole in an upper floor big enough that a man may with ease go up and down, and turn and wind in it; then tack on a hoop about the mouth of the bag fast with pack-thread, that it may bear the weight of the hops when full, and of the
man

man that treads them; then let the bag down through the hole, and the hoop will rest above, and keep the bag from sliding wholly through; into which bag cast in a few hops; and before you go in to tread, tie at each lower corner an handful of hops with a piece of packthread to make a tassel, by which you may conveniently lift or remove the bag when it is full; then go into the bag and tread the hops on every side, another casting still in as fast as you require them, till it be full. When it is well trodden and fill'd, let down the bag by unripping the hoop, and close the mouth of the bag, filling the two upper corners as you did the two lower.

This bag well dry'd and pack'd, may be preserv'd in a dry place divers years, if the mice spoil them not.

This done, return to the hop-garden, and preserve the poles for another year.

Strip the hawm clean from the poles, and set three poles triangular, spreading at bottom, and tied almost at top: against these you may set all the poles: bind them about with a little hawm twisted. Thus the outward poles are only subject to the injuries of the weather, except the tops.

There are variety of ways to preserve *hop-poles*; but the best is, when they are thorough dry, to lay them up in a dry house. Next *Friday* expect more from

Yours,

JOHN HOUGHTON, F. R. S.

FRIDAY, *Novemb.* 3. 1699. NUM. CCCLXXX.

Dung for hops what best. When hops first brought to England. Great profit by hops. Kent's management of hops. The charge of dressing and gathering of hops.

IN the winter you provide manure for the *hop-garden* against the spring. If your dung be rotten, then mix it well with two or three parts of common earth, and let it lie till the spring.

This will serve to make up the hills with.

If the dung be new, then, when mixed, let it lie another year; for new dung, my author says, is injurious to *hops*.

Horse dung and *cow dung* are very good; but none can compare with *pigeons dung*, if a little only be well mixt in a hill, that it may not be too strong in any one place. *Sheeps dung* also is very good.

In spring or summer if you steep the dung of *sheep*, *pigeons*, or *hens* in water, till quite dissolv'd; and when you water your hops, if you put a dishful of this dissolv'd dung among the water you water your hops with, in the hollow place made to contain the water, on the top of every hill, the virtue will be carried to the roots of the hop, and it may prove the most expeditious, advantageous, and least expensive way of enriching the hop hills of any other.

Thus

of HUSBANDRY and TRADE. 457

Thus you may convey to the roots of any vegetable the inherent or attracted virtue in lime, ashes, or any other fertilizing subject.

A friend of mine near *Maidstone* in *Kent* tells me they were brought from *Flanders* into *England*, Anno 1524. in the 15th year of *K. Henry* the 8th; before which *Tunhoof* or *Alehoof* was generally us'd.

Very great improvements have been made by hop gardens, not only in the *West* but especially in *Kent*; and he has been credibly inform'd, that *Maidstone*, and five miles round it, receiv'd two year since two hundred thousand pounds for hops exported thence that year.

The planters thereabout dig and dung the hop-garden about *Christmas*, and some time after they raise many hillocks in rows, about a yard distant from each other.

The plants are set about *April*, and then are fixt into each hillock three poles about eight foot long; but at three years growth they set poles of twelve or sixteen foot long, according to the strength of the ground.

This may be carefully dug and drest for about three pound an acre, which may probably yield half a load of hops one year with another; which, according to the price for two or three years last past, may be valued at one hundred pound.

They are gather'd about the beginning of *September* for eight-pence the day; after which being thoroughly dried over a kiln, they are bagg'd and sent to *London*. Next *Friday* expect more from

Yours,

JOHN HOUGHTON, F.R.S.

FRI-

FRIDAY, *Novemb.* 10. 1699. NUM. CCCLXXXI.

How many hops imported to London Anno 1694, 5. What is often used in lieu of hops. Weld or woad, its description. Where 'twill grow. How sown, how much seed to an acre, when and how gathered. What good for. How much imported Anno 1694, 5.

WHAT I have to say more of *hops*, is, that in the year 1694, 5, there were imported from *Flanders* 498 C. from *Holland* 12 C. in all 510 C. which at seven pounds the hundred (and they have been much dearer) amounts to 3570 pounds. This was to *London* only: how much the rest of the kingdom had I know not.

I must confess, this is no great sum: and if in time of dearth we will not allow one nation to help another, I doubt it will bring us to great inconveniences, although I would have hops planted more in *England*, that we may always be upon the selling rather than buying side: but whether a dearneſs ſometimes may not be the beſt means for an increaſe; or a conſtant plenty would not hinder the finding out of ſomething that is better, I know not; although I think *aleboof*, *ginger*, *borehound*, *wormwood*, *broom* and *gentian* are none of them reckon'd ſo good as hops; becauſe when hops grow cheaper, they are generally diſuſed.

The

of HUSBANDRY and TRADE. 459

The next in course is *weld* or *woad*, which is one of the *capsulate* herbs whose flowers consist of four leaves, and is farther distinguish'd by the flower in respect of the colour, being a yellow large plant, whose leaves are of a *bluish green*, long and smooth, used in *dyeing*.

This rich commodity grows in many places wild; but 'tis also sown in many places in *England* to great advantage. It will grow on any ordinary, or barren, dry and warm land.

It may be sown after barley or oats when they are harrowed, this requiring only a bush to be drawn over it. A gallon of seed will sow an acre, it being very small, and 'tis best to be mixt with dust, fine sand or some such like, whereby you may take up a handful. It groweth not much the first summer; but by preserving it from beasts and annoyances, after the corn is gather'd, you may the next summer expect a crop.

Take care to gather it in good time; for if over-ripe, the seed will fall out; if under ripe, neither *seed* nor *stalk* will be good: 'tis pull'd as they do *flax*, by the roots, and bound in little handfuls, set to dry, and then housed. After this they beat out the seed, which is of a good value, and sell the roots and stalk to the *dyer*: and 'tis of singular use for the dyeing of the *bright yellow*, and *lemon colour*.

In the year 1694, 5, there was imported from *Flanders* eighty hundred weight.

I hope by degrees we shall get all the husbandries that are in *Europe*. Next *Friday* expect more from

Yours,

JOHN HOUGHTON, F. R. S.

FRI-

FRIDAY, Novemb. 17. 1699. NUM. CCCLXXXII.

Anise described. Several seeds. Turneps, their advantage. Carrots, their advantage. Brandy from carrots, parsnips, and turneps. Advantages of the Royal Society. Rice in Carolina. Carraway-seed, its improvement.

THE next in course is *anise*, which is an *umbelliferous* herb, whose leaves are more broad, and less finely cut. 'Tis of the odorate kind, and of a strong scent, of the more pleasant sort, and distinguishable upon account of leaves, as to their shapes, having different shapes in the same plant, the lower leaves towards the bottom of the stalk being rounder and broader than *coriander*, and those upon the stalk more finely cut, having aromatick small seeds.

As for this *anise*, *coriander*, *carrot*, *wild carrot*, *carraway*, *cummin*, *staves-acre*, *kidney-bean*, *pease*, *bean*, *lupin*, *fænugreek*, *turnep*, *navew*, *mustard*, *poppy* and *cold seeds*, there is not much to be said to them; only methinks if *anise*, *wild carrot*, *cummin*, *staves-acre*, and *cold seeds* will not grow in *England*, 'twould be no great difficulty to make them grow in the *West-Indies*; and as for the rest, I think they all thrive very well in *England*; and I wonder that *kidney-bean* and *lupin* do not grow common field plants, and used by our husbandmen, rather than gardeners.

As

of HUSBANDRY and TRADE. 461

As for *turnep*, I need not give the manner of its culture, because 'tis generally known, but it has been a very advantageous seed for many parts of *England*; for they sow it immediately after the early crops, and then it proves good feed for great cattle, and also for sheep in winter; whereby the ground is so well dung'd, that it produces for some years extraordinary crops.

Carrots grow in *England* abundantly; and beside their being a food for men, I hear they are excellent to fat horses with, and poultry eat them greedily.

They grow best in sandy ground, but other light ground well dunged may do, but it must be deep dug, that there may be room enough for them to shoot downwards.

I hear of late that there is a patent for distilling of spirits from carrots and parsnips; and that they yield very well, but parsnips yield what is most like *French brandy*. Oh, the vast number of inventions and great advantages accrue to a trading nation! Nothing can be in any country, but one or other is apt to bring some account of it home; and especially here in *England*, since the *Royal Society* was founded, who are always enquiring what is done abroad, and telling all the travellers they meet with what they should enquire after, as to my particular knowledge they have lately done to those that are gone and going to *India* and the new settlement in *China*: also Mr. *Ashby*, by his conversation with such, was encourag'd to send a hundred pound bag full of *rice* to *Carolina*: from which rice, I am told, came last year hither sixty tun.

As for *carraway-seed*, altho' 'tis scarce now, yet not many years since a friend of mine near *Colchester* produc'd so much, that 'twas sold for

two-pence, and I believe less, the Pound. I am afraid his great quantity did him damage, but however, I believe 'tis made now one of the *staple pieces* of husbandry: and why if our gentry go on in gardening we may not naturalize a great many *exoticks*, I know not. Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, Nov. 24. 1699. NUM. CCCLXXXIII.

Pellitory of Spain, polimountain, dittany, teasel, colocintida, scammony. Teasels, *their use*. Colocintida *used instead of hops*. Scammony *described, its use*. Tobacco *described. How much imported 1694, 5. Its custom.*

THE next in course are pellitory of Spain, polimountain, dittany, teasel, colocintida, and scammony, which are things I would be glad to have grown here; but except *teasel* I believe the value is not very considerable; but *teasel* is of very great use among our cloth-workers; for they set a great many of them together upon wooden handles in a semi-circle, and with them *rew* the woollen cloth and make a *knap*, and if it was not for these, they must (I believe) use cards made of wire, which would be much more chargeable, and it's probable not so useful.

Pellitory, polimountain and dittany, I think, are us'd only in physick, but *colocintida*, by reason of its bitterness, is used for the destruction of
buggs,

of HUSBANDRY and TRADE. 463

buggs, fleas, and several other things; but whether they are successful I will not affirm; but the seeds, in time of hops being very dear, have been us'd in beer, as they use wormwood, *carduus benedictus* and *gentian roots*.

As for *scammony* it is of some considerable value; therefore I shall describe it. It is a *climbing campanulate herb, capsulate*, having a short round seed vessel and angular seeds, climbing by twining about other plants, and that, which hath a milky juice in the root, a violent purgative. In the year 1694, 5, there was imported one thousand two hundred and seventy four pounds; which might at first penny be worth seven or eight hundred pounds, according as it was in fineness; that which comes from *Aleppo* being generally much more resinous and fine than what comes from *Smyrna*, altho' of late some has come as fine from *Smyrna* as most use to come from *Aleppo*. 'Tis used in most strong purging pills and some powders: there is also *rosin* made from it, but I think most folk use the powder prepared, and called *diagredium* rather than the *rosin*, which, without it be greatly divided by some other powder, is apt to cling together, and will hardly dissolve in the stomach.

The next in course is *tobacco*, which is also a *campanulate herb, erect*, considerable for the flower, being of the lesser sort, which hath a narcotic quality, with large, smooth, unctuous leaves, but very small seed.

Of this *tobacco* there was imported to London in the aforesaid year (2129393 l.) two millions, one hundred twenty nine thousand, three hundred ninety three pounds, and 31149 hogsheads, which at three hundred to a hoghead (and some hold almost as much again) amounts to (9344700 l.)

464 *A COLLECTION for Improvement*

nine millions, three hundred forty four thousand, seven hundred pounds; in all, eleven millions, four hundred seventy four thousand and ninety three pounds.

This pays five pence the pound custom, which amounts to 239043 pounds twelve shillings: from this there is a draw-back for what of it is exported. Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, *F R.S.*

FRIDAY, *Decem.* 1. 1699. NUM. CCCLXXXIV.

Tobacco exported. What profit it may bring to the crown. K. James's book. Six-pence the pound custom. How much it may amount to. We do not seem to spend three quarters of a pound for each head.

IN my last I told you that five pence the pound custom amounted in *London* to 239043 *l.* 12 *s.* but there was a draw-back. There comes abundance more to other ports, where 'tis unladen, the duty paid and re-shipt for *Holland* and other Places. Truly how much all may amount to I know not; but I think that I have heard that it brings to the crown clear profit 150000 *l.* the year: surely had King *James I.* foreseen this, he would never have taken the pains to have writ a book against it; but he did not love it, and truly 'tis very noisome to those that are not used to it; but what will not interest and custom do? As he did not love
love

love the smoke of it (and I think, snuff of it was not then known) so I cannot learn that any of his family have loved it since they have valued pleasant things above their profit: but I do not doubt but if the males and females of the royal family would take it, 'twould quickly double the consumption.

I calculated before at five pence the pound custom, for what was spent here; but I understand since six pence is paid.

I find there are but six millions of six pences in 150000 *l.* and I am told by some that should know, that two thirds of all the tobacco that comes are exported by certificate; if so, then five millions of six pences comes to 125000 *l.* and ten Millions of half-pence (which is all that exported pays) 20833 *l.* in all 145833; so that 4000 *l.* more will do. At this rate the people of *England*, reckoning them at eight millions, spend not one with another three quarters of a pound in a year, allowing all that is wasted into the bargain; which truly at first sight seem'd to me much less, than what I thought had been consumed, notwithstanding the generality of women and children in *England* and *Wales* take none; but whether any of the custom be sav'd, or it is not yet got into use in several parts of the kingdom, I will not determine: but I doubt not but ways might be found whereby there might be spent twice the quantity.

The stalks I know are flatned in rowling-presses, then cut and smoaked, whereby there is little waste; and the smaller parts of the cuttings, that were called dust, and wont formerly to be thrown away, are now turned into *snuff*: but however the drying of it must waste it: and I think there is none cut but what is also dried, and there

464 *A COLLECTION for Improvement*

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466 *A COLLECTION for Improvement*

must be some reason for raising it from nine or ten pence to two shillings the pound. Next Friday expect more from

Yours

JOHN HOUGHTON, F. R. S.

FRIDAY, Decem. 29. 1699. NUM. CCCLXXXV.

Snuff. Divers sorts. Tobacco improves other trades, is of use in medicines. Its culture and cure. Making strong tobacco mild. Tobacco now sent to Muscovy. Whether best to plant here or no.

IN my last I told of *flatning* tobacco-stalks: of them is made a coarse sort of *snuff*; but there is variety of snuff made with good tobacco, viz. *English, Spanish and Portugal*, beside such as these variously and some richly perfum'd. The King of *Portugal* makes a great advantage of his taking care that all be good, and having his seal to it.

As the smoaking of tobacco has been the means of consuming a great many other things (as pipes, candles, paper, boxes, not only of small, but very great values) so snuff has done the like: for the boxes are innumerable, and the values of some extreamly high.

Tobacco rightly order'd is of very good use in medicine.

I am told that it affects a rich, deep and warm soil, drest in the spring before planting time. The young plants are rais'd on a hot-bed from seed in

of HUSBANDRY and TRADE. 467

February or *March*, then planted abroad in the prepared ground, which sometimes yield two crops in a year. The leaves, when gathered, are first laid together on heaps for some time, and then hang'd up in the shade (by threads run thro' them) until they are thoroughly dry, and then pack'd; but experience will be the best school-master.

I knew a great tobaccoist, who got a name and a great deal of money, by cutting strong tobacco, they treading it hard into earthen pots and so kept for a year, two or three. This would make the *Virginia* very mild like *Spanish*.

The *Virginia* trade is likely to encrease; for I have been informed the *Czar* of *Muscovy* has granted a set of our merchants leave to carry into his country six thousand hogsheds in three year.

The planting it here is forbid; because it employs so many ships, and brings so much money to the crown; and perhaps it may be a good reason, altho', as my author says, a high duty on it here might recompence, and why should we not get all the husbandries here we can, that are profitable? Perhaps ours is not so good as the *American*; then those that like that, and are able, will have it still; if not able, they could not have it before. The *Germans*, I am told, do make a great deal, and roll it up with our bright and large leaves: if they can so under-sell us, then they will plant abundance; and upon that consideration our planting may only beat them out of that trade, and not prejudice the other: for if we won't plant it, they will. Interest won't lye. I only say, let this be considered. For my part I won't determine. Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

H h 2

FRI-

 FRIDAY, Dec. 15. 1699. NUM. CCCLXXXVI.

Birthwort, its description and use. Potatoe, its description, by whom first brought into Europe. A good support. Spanish potatoes.

THE next in course to tobacco is *aristolia* or *birthwort*, which is a *capsulate* herb, not *campanulate*, having its leaves divided into several segments, with *leafy stalks*, one of the taller plants, considerable for having small dusky flowers, a roundish leaf and weak stalk, the flower being a kind of *tube*, with a lip on one side.

Of this there is a great deal imported for physical uses, altho' in the year 1694, 5, by reason of the war, I find but 220 l.

'Tis greatly used in ointment of *tobacco* and *Paracelsus* plaister; and time, I hope, will naturalize it here (altho' now it grows in the *Streights*) as well as it has done *potatoes* from *Virginia*, which is the next in course.

Potatoe is a *bacciferous* herb, with *esculent* roots, bearing winged leaves and a *bell* flower.

This I have been inform'd was brought first out of *Virginia* by Sir *Walter Raleigh*, and he stopping at *Ireland*, some was planted there, where it thriv'd very well and to good purpose: for in their succeeding wars, when all the corn above-ground was destroyed, this supported them; for the soldiers, unless they had dug up all the ground

ground where they grew, and almost sifted it, could not extirpate them; from thence they were brought to *Lancashire*, where they are very numerous, and now they begin to spread all the kingdom over.

They are a pleasant food boil'd or roasted, and eaten with butter and sugar.

There is a sort brought from *Spain*, that are of a longer form, and are more luscious than ours; they are much set by, and sold for six pence or eight pence the pound.

Whether these differ any more than what is caused by the different soils they grow in, I know not.

They are easily encreas'd by cutting the root in several pieces; for each piece will grow. They require a good fat garden mould, but will grow tolerably in any. Surely in some places it may be worth while to plant abundance, if it were only to feed their cattle and poultry. I believe the more husbandries we have, the better. Next week I shall begin with the vine, and am,

Yours, &c.

JOHN HOUGHTON, F. R. S.

 FRIDAY, Dec. 22. 1699. NUM. CCCLXXXVII.

The vine, its description. The quantities of wine, brandy, cremor tartar, argol, vinegar, and rape, imported to London anno 1694.

NOW in course I am come to the *vine*, which is a *bacciferous* shrub, of *deciduous* leaves, not *spinous*, whose berries are *esculent*, bearing their fruit in clusters, which yield a rich juice: it has a spongy wood and trailing branches.

Of these berries are made *wine, brandy, cremor tartar, argol, vinegar* and *rape*, of which anno 1694. there was imported to London from the *Streights*, of wine 15 butts, 76 casks, 77 chests, 5 hogsheads, 18 pipes, and 361 tuns.

Of *brandy*, 1 butt, 1 cask, 27 pieces and 9 tuns.

Of *cremor tartar*, 105 C.

From *Dantzick* 2 casks of *rhenish wine*.

From *America*, 1 cask of *wine*.

From *Holland*, of *wine* 236 aums, 1 butt, 214 casks, 178 fats, and 1401 pieces.

Of *brandy* 5 casks. Of *argol* 59 C.

From *Spain*, of *wine* 5581 butts, 344 casks, 3 chests, 443 hogsheads 3143 pipes, 1 tierce, 138 tuns.

Of *vinegar* 1 hogshead. Of *brandy*, 25 butts, 138 casks, 5 hogsheads, 68 pieces and 45 tuns. Of *argol*, 305 C.

From

of HUSBANDRY and TRADE. 471

From *England*, which I suppose to be prize, of wine, 12 butts, 4 casks, 36 hogsheads, 138 pipes and 93 tuns.

Of *brandy*, 33 casks and 296 tuns.

From *France*, of rhenish wine 2 casks.

From *Canaries*, of wine, 45 casks, 18 hogsheads, 2853 pipes.

Of *brandy* 1 cask and 25 hogsheads.

From *Portugal*, of wine 915 butts, 353 casks, 1198 hogsheads, 57 pieces, 15930 pipes and 34 tuns.

Of *brandy* 51 casks, 5 hogsheads, 4 pipes and 3 tuns. Of *argol* 238 C. *Rape* 3 tuns.

These make in all, of wine 236 aums, 6524 butts, and 1041 casks, 79 chests, 178 fats, 1700 hogsheads, 1458 pieces, 22082 pipes, 1 tierce and 626 tuns.

Of *brandy* 26 butts, 229 casks, 35 hogsheads, 95 pieces, 4 pipes and 353 tuns.

Of *cremor tartar* 105 C. Of *argol* 602 C. Of *vinegar* 1 hogshead. Of *rape* 3 tuns.

Several of these measures are uncertain; but I guess them altogether to make between sixteen and seventeen thousand tun, which is but a small matter, considering what was brought in before the war: for I have been told by the city cauger, that then has come to *London* in one year one and thirty thousand tun of wine. Next *Friday* expect more from

Yours,

JOHN HOUGHTON, F. R. S.

FRIDAY, Dec. 29. 1699. NUM. CCCLXXXVIII.

About one gallon of wine the head spent in England in a year. 'Tis good husbandry, and will much encrease our strength.

IN my last I gave you an account how much wine, brandy, cremor tartar, argol, vinegar and rape, was imported to London anno 1694, and how much of each sort, and how much from each country, and that of wine was about 17000 tun, and not much more than half what has been in some years of peace: for I have been inform'd of 31000 tun, which multiplied into gallons by 252, makes (7812000) seven millions eight hundred and twelve thousand gallons, which is much about one gallon the head for every one in *England* in a year.

Beside this there was imported a great deal to other places.

Now it is to be consider'd whether this be good husbandry for the nation or otherwise.

A great many think it is not; yet they make some difference betwixt what we buy for goods, and what for mony; altho', as they say, 'tis all piss'd against the wall.

I must confess I am of a different sentiment, altho' I am no great wine-bibber, neither would I have any body debauch'd: and also I confess that I think it would be better, if we could make all sorts of wine in the world grow here; for then we should have more materials, where-
with

of HUSBANDRY *and* TRADE. 473

with to buy in more of such goods as we cannot have; but seeing as yet we know not how to accomplish this, I think, in order to our wealth and strength, it would be better if every body, instead of one gallon, drank thirty each year; so we fetch'd it in our own shipping.

The consequence of this would be, that if we fetch'd (930000) nine hundred and thirty thousand tun, this would employ 4650 vessels of 200 tun each for one voyage: or if two voyages, 2325 vessels, which at ten men each, or one man to 20 tun, as is usual, 'twill make 23250 seamen, who then should dare to quarrel with us, if we had so many seamen by means of trading in one commodity.

I also pray you to consider the great number of ships will be more employ'd by bringing the timber, masts, iron, hemp, sails, and all other necessaries needful for the building, storing, and victualling of all these vessels. I won't determine, but doubt not but they will appear to all to make a great addition. Next *Friday* expect more from

Yours

JOHN HOUGHTON, F. R. S.

FRI-

FRIDAY, Jan. 5. 1⁶⁹²/₇₀₀. NUM. CCCLXXXIX.

Wine paid for with ready-money will not impoverish us. A swap hurts not a nation. We do give nothing but our own product for our wine: and money, if a nation wants it, will come in as fast as 'tis carried out. How to employ the poor recommended to the parliament.

LAST week I shew'd you how 'twould increase our strength, should we drink thirty times the wine we now do. I now say, that it will not decrease our wealth, suppose we should piss every drop against the wall, and pay for every drop with ready-money, which is the worst case I think we can put it in.

I presume that if we were to swap corn of our own growth for wine, none would think 'twould ever undo us; because to increase and procure that corn, we should only employ our idle land, and idle hands; and 'twould be no more than if we brewed that corn into drink, or distill'd it into spirits, and drank it; only as in my last, we should be stronger by the shipping we employ'd.

But in effect, I say, we do give nothing else but what is procured by our otherwise idle ground or hands; for the money does not grow in *England*; how then do we get it? Why, for our growth, manufacture, or merchandize gotten for our growth or manufacture: and if
so,

of HUSBANDRY and TRADE. 475

so, then all the wine we drink is the product of nothing else but our growth and manufacture.

But some (tho' with little reason) will still urge that it will carry away our ready-money, or hinder the bringing it in, which is much at one. Alas, poor souls have they no farther foresight? Do they not remember the case of the guineas, when at thirty shillings how fast they came in: and suppose we should send out a million sterling for wine, would not this make money with us scarce, and will not that make it dear? That is, will not they that want sell their commodity cheaper, or one way or other allow a higher interest? And will not its dear-ness bring it over from *Holland*, and other our neighbour countries? Do not all *merchants* carry their commodities to that, which (all things consider'd) they believe will be the best market? If they will, then they will always do so, as long as this shall continue the best market; and this will always be the best market, till there does come in so much as will mend the scarcity, supply our needs, and make us as easie as we were before we carried any out.

This will employ our poor, and increase our trade; for of necessity, if we carry out a million extraordinary for wine, and spend thereby no less in other things, we must export a million of goods extraordinarily yearly, to pay for the money we must have to supply this wine trade.

If the parliament will be pleas'd to consider this and other parallel cases, I, with humility, presume there will not want employment for more people than now complain of bad trading. Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRI.

 FRIDAY, January 12. 1⁶⁹²/₇₈₂. NUM. CCCXC.

Exportation must answer importation. We may sell our manufacture as cheap as the Dutch can. Wool plentiful, yet dear. The East India companies cause a great exportation of woollen manufacture. Some will always complain.

IN my last I represented to the parliament that an extraordinary expence of a million the year in wine would certainly mend our trade, so as to make our extraordinary exportations be a million; and although I have made it so plain as to defie the world to gainsay it; yet to answer all objections, tho' they have but a colour of reason, I must say more.

'Tis objected, that when guineas came in at 30, the *Dutch* bought so much of our manufactures at profitable rates, as afterwards to undersell us at the markets we were wont to serve.

I hope they sold cheap also, and therefore more at the markets they were used to serve, and also found out some new markets; which usually is the effect of being clogged with goods: but why if we sell an extraordinary quantity one year, and do not sell so much the next, must we complain of bad trade? but if we had but a small trade with our neighbours the second year, why might we not sell at far off markets as cheap as they? will we keep our goods to rot, rather than sell at a low price? no sure, no more than

of HUSBANDRY and TRADE. 477

than they : but we have had no destruction of sheep by an inland war, nor any extraordinary rot ; so that our quantities of wool have no ways lessened, and we have spun it rather finer than coarser ; and I presume more care has been taken to hinder its exportation ; yet notwithstanding this, our places have not much declined, neither do our people complain of the excessive lowness of wool, which would certainly have been if our trade had been much decayed : and I am also told that we never had a greater exportation of woollen manufactures than since the peace.

Moreover surely the *Dutch* did not undersell us in those places where they do not trade, as to our *West* and *East-Indies* ; and by the way, the more we use of their goods, the more they'll take of ours ; and the *new East-India* company are obliged to send the tenth part of all they send, in woollen manufacture, and the old company for 100000*l.* the year ; notwithstanding this, they are reckoned to be the cause of all the decay of our trade, without considering the prohibition of our woollen manufacture in *Flanders*.

The sum is, there are traders to furnish all fashions ; wherefore, if at any time a fashion changes, tho' the general trade be never so good, these traders will complain ; and if their complaints can help them they are not to be discouraged : but for those who pretend to understand the general trade, if they complain, then 'tis a sign they are ill humoured, or their upper rooms want furnishing. Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRI-

FRIDAY, Jan. 19. 1777. NUM. CCCXCI.

Best wine how made. Vintners art. Ferment helped and hindered. Divers Wines mended.

IN my two last I believe I have shewn beyond contradiction, how any government may gain as much *trade* and *wealth* as they can desire with any tolerable *pretence*, and without much difficulty or trouble; but if the parties concerned think not fit to mind so considerable a proposal, I can't help it: however I have done my part, and will go on with my history of *wine*.

A great many do not reckon the best wine to be made from full ripe *grapes* and *gentle-pressing*; but yet, as I am informed, if such be not duly *fermented*, kept in proper places, and drank in its proper seasons, there may be as much danger from it as often is from sophisticated liquors; and to manage these aright, requires a considerable artist, and when all is done, generally speaking such wine now-a-days will please the palates but of very few; whether it be from the *nature* of the wine, or the *depravedness* of palates, I won't determine.

But however the *vintner's* chiefest art now-a-days is how to meliorate these wines by increasing their ferment when they are over-green, or not fully ripe, and lessening of it when they *ferment* too much.

The *ferment* is helped by vaults that are warm of themselves, or made so by certain *degrees* of fire: also the *Spaniards* use *Cresto* to help the *fermentation* of their *Canaries*; others here use di-
vers

of HUSBANDRY and TRADE. 479

vers mixtures of *wine* or *lees*, whereby they perform that; and some use several other juices, as of *elderberries*, *black-berries*, *apples*, and preparations from *sugar*, and several other mixtures.

Some *wines* will spend themselves over-fast; but these are preserved by *Hieffo*, the sulphurated match and racking.

Often *wine* will be very unfine, which is helped by mixing with it *ising-glass* dissolved in some of the hardest *French wine* to a gelly; this by its clamminess gathers together the foul particles, and throws them in strong *wines* to the top, and in small to the bottom. *French wines* must be well bunged, but not *Spanish*.

Wines will lose their colours, but *clarets* are helped by other high red *wines*, *turnsole*, or some other red juices. Brown *wines* are helped, by *alabaster*, and much stirring; also by *starch*, *milk*, *orrice*, *salt-petre*, and *ising-glass* or *whites* of eggs.

Muddy and tawny *clarets* are cured with *fair water*, eggs and *salt*.

To amend the smell and taste of *Malaga* is made an emulsion of almonds made with *wine*, *whites* and *yolks* of eggs, and *salt*.

To do the like for *rhenish*, they use *honey*, *elder-flowers*, *orrice*, *nutmeg*, *cloves*; and *spirit* of *wine* makes any *wine* fine and brisk. I only give *generals*, but doubt not but vintners have as good and shorter ways than any theoretical gentlemen can have.

Yours

JOHN HOUGHTON, F. R. S.

FRI-

 FRIDAY, Jan. 26. 1⁶⁹²/₇₀₀. NUM. CCCXCII.

Curing of several decayed wines. The reason for use of ashes.

IN my last I gave some account about the ordering of *wines*. I go on.

Roapiness is cured by beating a quart of the *lees* of vine-branch ashes into a pipe; and so does infallibly a lee of oaken ashes. Rack *Spanish* roapy wine from the *lees* into a new *scented cask*, then take allom one pound, orrice-root half a pound; powder both, and beat them well into the *wine* with a staff: some add fine and well dry'd sand put warm to the *wine*. If the *wine* beside prove brown, add three pottles of milk to a pipe.

N.B. I presume that the ashes of any *vegetable* will do: for 'tis the fixt salt in them that does the business, they being *alkali's* that destroy the *acid*, which is a decay in the *wine*. If this be so, then any *alkali* is also good, although the liquid *alkali's* may mix best, and dispatch the business quickest.

Herring-roes preserve any *stum wine*.

In *June* wines begin to fret, and grow sick; then disturb not *rhenish* by removal or filling; only open the bung, and cover it with the slate, both which cleanse from their filth when need is; the *fermentation* ended, which you may know by the ear; let the *cross lee* settle ten or twelve days; then rack it into a fresh *scented cask*.

The

of HUSBANDRY and TRADE. 481

The following mixture helps ill wines in *smell* and *taste*. Take one part of honey, and two of rain-water; boil them to a syrup, adding at the latter end a third of sound old wine, of the same kind; let it be well scummed, and added hot to the wine in a *vessel* of fit capacity, and stand unbunged till cool. Some, to better this, add a bag of spices. This will fine any wine, and mend the hard taste, putting a gallon to a hoghead, using the rod, and letting it settle five or six days.

A strong decoction of *beet* roots in claret added to a hoghead of it will *mend* the colour, and *preserve* it.

A decoction of *wine, rain-water, honey, beet-root* and *mulberries* will do the like.

About ten eggs cracked at one end and put into a *tierce* of claret will *preserve* it.

Grains of *paradise*, or *lavender-tops*, put into *French wines* will *preserve* them.

Sour *French wines* are helped by putting in wheat boiled till it breaks; and some put in five or six canes of cinnamon.

Spanish four wines are helped by racking, and filling up with two or three gallons of water, adding four ounces of *lime*; if this does not do, after three or four days it must be repeated. If the wine should grow bitter, correct it with *nutmegs* and *cloves*. Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F. R. S.

FRIDAY, Feb. 2. 1692. NUM. CCCXCIII.

A farther account of helping defective wines. Firing of wines. Stum what it is.

IN my last I gave some account to help *defective wines*. Furthermore, to help *stinking wines*; take *ginger* half an ounce, *zedoary* two drams; powder and boil them into a pottle of good wine, which put scalding hot into the vatt, bung it up, and let it lie. *Species diambrae*, and *diamoschu dulcis* do the same; and so nutmegs and cloves, which also give a kind of *raziness*.

For wine that hath an ill favour from the *lees*; first rack it into a clean cask; and if red or *claret*, give him a fresh *lee* of the same kind: then take cloves, ginger and cinnamon, of each two ounces, of orrice four ounces: powder them grossly; hang them in a bag in the wine, and taste the wine once in three days; and when 'tis amended, take out the bag. Some take cloves half a pound, *mastick*, ginger, cubebs, of each two ounces, Spikenard three drams, orrice-root half a pound; make thereof a fine powder: put it loose into the vatt, and use the rod, making a good fire before it.

Firing of *wines* in *Germany* is thus performed: they have in some vaults three or four stoves, which they heat very hot. Others make fires almost before every vatt: by this means the *must* fermenteth with great vehemency. When this ebullition, fermentation or working ceaseth, let the

of HUSBANDRY and TRADE. 483

the *wine* stand some days, and then rack it. This *firing* is only performed in cold years, when the *wine* falls out green.

Stum is naught else but pure *wine* kept from fretting by often racking it, and matching it in clean *vessels*, and strongly scented. By means of new matching, it becomes as clear, or clearer than any other *wine*, preserving it self by both its *lees*, and by precipitating of them. But if through neglect it over-fret, it becomes good *wine*. The bung must be continually stopt, and the *vessel* strong, lest it break. A little *stum* put into decayed *wine*, makes a *ferment* afresh, and gives life and *sweetness* thereto, but offends the head and stomach, *ferments* the guts, and is apt to cause looseness, and some say barrenness in women.

To fine *wine* presently, fill a cask with shavings or chips of *beech*, or, which is better, *oak*; then pour in as much *wine* as the cask will hold, and in twenty four hours twill be fine: or a quart of vinegar in three days will fine a hoghead of *wine*.

To fret old *wine* being deadish or dull in taste, take of *stum* two gallons, put it hot into a hoghead of *wine*; then set a pan of *fire* before the hoghead, which will *ferment* till the *sweetness* of the *stum* is communicated to the *wine*, which thereby becomes brisk and pleasant.

Some *stum* at any time, some in *August* only; when the *wine* hath a disposition to fret it self, more or less *stum* must be added, as the *wine* requires.

Yours, &c.

JOHN HOUGHTON, F. R. S.

 FRIDAY, Feb. 9. 1722. NUM. CCCXCIV.

A farther account of helping wines.

IN my last I gave some account of wine. Yet further.

The best time to rack wine is in the decrease of the moon, and when the wine is free from fretting; the wind being at northwest and south, and the sky serene from thunder and lightning.

Another match for *French* clarets and *Spanish* wines. Take *orris-roots*, *masfic* and *brimstone*, of each four ounces, cloves two ounces, ordering as in my former paper in matching wine. This will serve for all wines, adding if you please nutmegs, ginger, cinnamon, and other spices; double the quantity of *orris-roots* is to be used for *Spanish* wines.

To help *Malaga's* that will not fine, take of crude tartar powdered, sifted, and dry'd, two pound: mix it with whites of eggs; dry, powder and sift again: then mix it with as much of the wine as is sufficient; put it into the pipe, which let be full, and then with a staff, as before, and this wine will be fine in ten days.

Another speedy way to fine *French* wines. Hang a piece of scent in the cask; and when it is burnt out, put in a pint of the best spirit of wine, and stir it about: some add a little salt well dried.

This fines wine in twenty four hours.

To keep must a year. Take a cask pitch'd within and without, then make it half full with
stun;

of HUSBANDRY and TRADE. 485

stun; stop the bung close with mortar. Others sew the cask in skins, and sink it for thirty days into a well or river: or else a garland of *polium montanum* hung in the vessel: or rub the inside of the vessel with cheese.

Alom put into a hog's bladder, and put into the cask, keeps wine from turning flat, faint or brown; and beaten with the whites of eggs, removes its ropiness.

Flat wines recover with spirit of wine, raisins and sugar, or molosses: and *sacks* by drawing them on fresh lees.

Our wine-coopers of later times use vast quantities of sugar or molosses to all sorts of wines to make them drink brisk and sparkling, and to give them spirit; as also to mend their bad tastes: all which raisins, cure and stun will perform.

Country vintners feed their fretting wines with raw beef; and here their canaries with Malaga, which is added more or less to all canaries.

Next *Friday* expect more from

Yours, &c.

JOHN HOUGHTON, F.R.S.

FRIDAY, Feb. 16. 1692. NUM. CCCXC.

A farther account of helping defective wines.

IN some of my former I have given some account of wine; farthermore the composition

486 *A COLLECTION for Improvement*

of wines is manifest, the vintners usually drawing out of two or three casks for one pint, to accommodate some sorts of *nice palates*, any of the *canaries* made with *Malaga* and *Zeres sack*, alias *sherry*.

My author, Dr. *Christopher Merret*, concludes with two compound wines, *muscadine* and *hyppocras*; the former is usually made with thirty gallons of *cute*, (which is wine boiled to the consumption of half) to a butt of *wine*, or the lees and droppings boiled and clarify'd, its flavour is made of *coriander-seeds* prepared, and shavings of *cypress wood*. Some, instead of *cute*, make it of *sugar*, *molosses* and *boney*, or mix them with the *cute*.

This following is a *hyppocras* of my author's making, and the best he had tasted. Take of *cardamoms*, *carpobalsamums*, alias *Jamaica pepper*, of each half an ounce, *coriander-seed* prepared, *nutmegs*, *ginger*, of each two ounces, *cloves* two drams; bruise and infuse them forty eight hours in *Zeres*, alias *sherry*, and *white wine*, of each a gallon, often stirring; then add thereto of *milk* three pints, strain through an *hyppocras* bag, and sweeten it with a pound of *sugar-candy*.

This account of *wine* was delivered to the *Royal-Society* October the twelfth, 1662. by Dr. *Christopher Merret*, a learned physician, and fellow of the same *Society*, and it's probable 'twas the best account could be given at that time; for I knew him to be a very inquisitive gentleman: yet I doubt not, but since that the practice for the cure of *wines* has varied as well as it has done for humane bodies; every artist strives to bring their matters to a nearer and more easie method, and especially since the high duties and dearness of wines: for the dearer they be, the more shall the *dealer* be encouraged to mix them

them with *more cheap materials*, supposing they can so do it, as to make it *please* the palates of their customers, and do them no hurt; for *interest* will not lye; and 'tis a very good prayer, not to be led into great temptations.

The things besides sugar and its compounds, now-a-days greatly used for mixture, are the juices of many fruits, as *goosberries*, *currants*, and what not: but those which make the bulk, are the juices of *elder-berries* and of the great *grape*, *anglicè cyder*; and if these be the worst, I do not see any great evil attends it; for supposing half our wines we drink were made of *English* materials, that would refresh us, *please* our palates and do us no hurt, will it not be, as to policy, the same as if half the wine we drink grew in *England*? and if so be we can support some of this, 'twill still be a *greater advantage*: and if so be some allowances were considered on for exportation, I know not why we may not serve some eastern countries as cheap as they can be served from the places where wines grow.

The end of the second volume.

...the things which they suppose they
...as to make it plain the palate of
...and do them no hurt; for
...and is a very good player
...into great temptations.
The things which are and its compounds,
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not see any great evil attends it; for supposing
half our wines we drink were made of this
material, that would be to us, they are our
and do us no hurt, nor be as to policy,
the same as if half the wine we drink grew in
France; and it is to be supported some of this
will still be a great advantage: and it is to be
some advantages were considered on for export-
ation. I know not why we may not have some
valuable countries as cheap as they can be served
from the places where wines grow.



The end of the second volume.

I N D E X.

N. B. The Figures refer to the original Numbers not the Pages.

A

A I R, *will do great things*, 284.

Alkali, *what it is*, 286. 336.

Alumen Plumosum. *Its description and use. Amianthus rock. Its description Where this stone is found. Manufactures from it. An oymntment with it. How much imported in 1694. 'Tis good for lampwick*, 202.

Amber, *what. Some found in the earth 25 miles from sea; divers sorts, where found, what good for. Counterfeit*, 204. *What worth yearly to the elector of Brandenburg. Price of great Amber. Great quantities in the Baltick. What 'tis thought to be. How much imported in 1694. Oyl and salt. A proposal*, 205.

Annis *described*, 382. *Several other seeds*, *ibid.*

Aqua Fortis and Aqua regia, *why so great dissolvents*, 223.

Aqua Fortis, *of what made*, 233.

Arsenick, *Its description, quantity and Use*, 243.

Arts *encouraged*, 204.

Afarum. *Its description and quantity imported*, 238.

Aloe. *Its description, whence brought. how the Gum is made, and called. Barbadoes Aloe. The leaves not bitter. Its uses*, 324. *A tree in flower in England*, 325. *How much gum imported, 1694-5*, 336.

B

B ARBADOES, *its bigness*. 316. *The best cultivated spot in the World. Ibid. Its militia. Their casualties*, 319.

Banks, *how to make*, 219.

Beer and Ale. *A comparison between them and the people. A proposal and reason*, 299.

Bezoar, *what, whence, and how much imported. Its description, the counterfeit. Gascoign's powder and Goa-stone, their description. Goa-stone good for*

INDEX.

- punch. Occidental Bezoar. Such like taken from oxen,*
206.
- Birthwort, *its description and Use,* 386.
- Boyling, *how to improve,* 235, 236.
- Brandy from carrots, parsnips and turnips, 382.
- Bricks, *how many imported Anno 1694. Notes on them,*
188.
- Brimstone and Fire in Sodom *thought to be lightning,*
223.
- Brimstone, *how much imported in 1694.* 237.
- Brine-Pans, *manner of making,* 220.
- Buck-Wheat described. *Its culture,* 340.
- W. J. Blaeu, *his life,* 367.
- C.
- CAREENING, *what,* 307.
- Carrots, *their Advantage,* 382.
- Carraway-seed, *its improvement,* *ibid.*
- Cheap selling gets trade, 343.
- China-ware made at Fulham flat, *but not so well round,*
and why. A proposal, 189.
- Clays burnt; *a list of 'em,* 188.
- A Coalition with Scotland *suppos'd a great advantage,*
178.
- Coal differs little from jett, 239. *How much imported*
in 1694. Coal in England like Scotch-Coal. Coals
what in Dr. Plot's opinion. Cannel-Coal like black
Marble. Its many uses. Where found and how deep.
The Lancashire-Coal is better than Staffordshire. Staf-
fordshire-Coal how managed for fires. Peacock Coal,
its use. The common coal very delightful. How many
Collieries. How many tuns some yield yearly.
From one shaft has been drawn 500 pounds worth of
Coals. Wood grows scarce in Staffordshire, and Coal
is burnt in Bed-chambers, *ib.*
- Coal, *used in most mechanical professions,* 241.
- Coaks dry malt. *How much coal boyls salt, and*
burns bricks. Several accounts of Coals, *ib.* *Near*
400000 chaldron in a year comes to London, which, in
likelihood, employs 333 ships, and 3333 seamen; and
at 10 l. the head each 160000 people. Pitch and tar
from thence, *ib.*
- Coloquintida, *its use,* 383.
- Colours, *how tin first used in Grain-colours,* 254.
Company.

I N D E X.

Company. *A regulated one, what.* 184. *Where regulation useful, but not to Guinea, and why. Objections answered. A censure of some printed papers,* ib.

Copper, *first material of money. How much imported 1694. and how much brass. Copper-mines, divers in England,* 255. *Oar in Staffordshire. The works of Copper laid down and revived in England. Five Copper stocks. Copper stocks have improved England greatly,* 256. *Great store of Copper-mines in England and Cornwall. Foreign Copper. An Account of Ercken's book of Copper. Calcining Copper with Pit-coal. A proposal. Battery and wire made as good here as any where. How much wire made a week. 'Twas made in 1649.* 257. *Brass, how made. Stones from St. Malo's, divers proprieties. How wire is made on a Battery,* 258. *How brighten'd, drawn for pins, streighten'd. How pins are pointed and beaded. How the heads are made and pins whiten'd. Their papers and manner of sticking and making up. The sorts of pins, their price and charge of workmanship. The hands employed in them,* 249. *Thimble-making, a patent. Shruff best for thimbles. How melted and cast. How Cores are managed, and Thimbles cleansed. Six employed in founding. How turned, and hollows made on the out-side and the rim. How wrapt up. The charge of the work. Quantity of thimbles made in a year, and their weight. The work at Marlow, which grinds seeds for Oil,* 260. *Divers Coppers in Gresham-College. Its separation from Oar. How Silver is got from it. How Copper is shap'd into vessels or plates. 60 l. of Copper from 100 l. of oar. A water that turns iron into Copper or something like it. Pins consume most Copper,* 261.

Coral, *what. Several sorts, where gotten; its generation, and use. Bastard Coral,* 203. *How much imported 1694. Bastard Coral and Coralline,* 204.

Cornelian. *How much imported 1694. What good for,* 207.

D.

DEAD. *Their disposal in divers nations particularly among Jews,* p. 325. *Other nations,* 326, 327. *Why Egyptians embalmed, ib. More ways. Egyptians and Romans were famous for embalment. A censure on*

I N D E X.

- sepulchral lamps. Embalming came from Hebrews to Christians, 328. The Jews management, 329. The Greeks management. Fear to die at sea, and why, 330. Farther account, 331, 332. How they burnt them, 332. Farther account about burial. The Greeks sacrifices. They thought all princes souls went to heaven, 333. Their farther management, and the Romans, 334, 335. They burnt, ib.*
- Destruction, its cause, 236.*
- Diamonds, how many imported, 1694. Their use: glass-house fire won't melt them, except mixt with some salts. Their value great: their political use. A rock of them. The 4 chief mines, 307. A mine in Borneo. How diamonds are figured. True diamonds unite soyl closely. Difference between the grain and vein. How split. Bastard diamonds. Cornish better than Bristol. We had formerly a great trade in diamonds. How to regain it, 208.*
- Dittany, its use, 382.*
- Dunghills, advice about them, 223.*
- Dutch thrive by undisturb'd joynt-stocks, and contrary impoverishes us. 180.*
- Dying materials dearer to our dyers than to foreigners, 338.*

E

- E**ARTH coloured, 188.
- Earthen-ware. What imported 1694, with a note and proposal, 188.*
- Earth salt, how to make it good land, 219.*
- Earth concretions dissolvable, what, 209.*
- Encouragers of exoticks, 339.*
- Engine-looms destroyed. Reasons for them, 353.*
- Evaporation. Its improvement, 214.*
- Euxine sea runs always outward, and is esteem'd salter than any, 210.*
- Exchange, its nature, 246.*

F

- F**ERMENTATION illustrated, 236.
- Fire, a quality. Cause of redness in Fire. Fire will volatilize heavy bodies, 284. Fire is like water in a Pump, 284. How Fire burns, and will burn without bellows. How Æolipiles work, 285.*
- Flanders netted, and prohibiting woollen manufacture,*

I N D E X.

353. *Reasons why we shall not lose it. A proposal to encrease it, 354.*
 Fluxing, *its manner, and reason thereof, 286.*
 Foyl for Diamonds. *How made, 208.*
 Foreigners, *what they may do with forts if we have none, 183.*
 France. *From thence came in 1668 1200000 l. Sterling in value; and Mr. Fortrey says 2600000 l. A proposal, ib.*

G.

GENTIAN. *Its description, uses and quantity imported, 323.*

Glass. *How made, 195. No wonder 'tis with sand. Divers sorts; the reason of glass-making. Neri's book of glass. The D. of Buckingham and M. Ravenscroft. What glass was imported to London in the year 1694. 196. Flint-mum-glasses and window-glass encouraged; of which we make the best in the world. Glass-bottles we hardly import. Glass-pipes, bugles, looking-glasses, necklaces, prospect-glasses, 191. Number of glass-houses, and how many for each sort of glass, 198. Glass-making. Lime-stones not fit for glass. What fittest, 199.*

Glass better at London than Venice, 179.

Globes, *their nature, ibid.*

Gold describ'd, 243. *Divers sorts of oar. One hundredth part gold, ib. In Scotland and England. Erckern's account of it, 245. How much imported anno 1694. 246. Some in tin, 251.*

Guernsey ought to be as much cultivated as Barbadoes, 180.

Guinea, *a probability of greater trade thither, and why. Commodities thence. 'Tis a brave country. The case of an open-trade there on sea or shore, 183. Great advantages of a joynt-stock to Guinea. The manner of selling of 70000 backs, 185.*

Gunpowder, *its parts and reasons of its operation, 222. Reason for pulvis pyrius or gunpowder, and office of every ingredient. Why it's granulated; and reason of its great power, 223. When, and by whom invented, 224. How probably found. Its history, 227. Of what wood. The secret in general, ib. Proportion of materials, 228. The mixture. The nitre must be dis-*

I N D E X.

solved, and why. The description of the powder-mill, ib. 229. How the pestles work and why. How powder is order'd in working. Signs of the mill firing. How powder is corned and dryed. The stove describ'd. How heated, ib. Drying of gunpowder, 230. Best in sun. Great corns for cannons; small for musquet and pistol. Difference of powder. 100 lb. is a barrel. Uses of gunpowder. It saves men from destruction, ib.

H.

HEMP and flax describ'd. How much of them and their manufacture imported 1694-5. 341, 2, 3, 4. A general account, ib. 345. Culture of hemp, ib. 346. Time of ripening, ib. Farther management, 347, 8. Spinning. No good cloth without even yarn. Bucking and rinsing, 350, 1. Weaving, how managed. Huggerbeck, diaper, damask. A loom and its attendance described, 351. Whitening and calendring. Thread-making, 352. Tape and filletting, much made in Manchester, 353. Thread-laces, bone-lace. Laws against its importations, ib. Point-laces, 354. Twine-whitening, dying, printing, maps, pictures, oil-cloth, buckrams, old-sheets, 355. Paper, 356. vide paper. Hyacinth. What imported. 1694. Their descriptions, 209. High-ways. A proposal for mending, 190. Holland an industrious place, and why, 237. Hop, its history and culture, 372. to 380. When first brought to England, ib. How many imported to London, 1694-5. ib. Honour. Barbarous or ordinary people seldom have it, 183.

I.

IDLENESS and penury, their cause, 186. Jerbo describ'd, 217. Price of its salt, ib. Jett, its description, 239. How much imported 1694. ib. India companies export much woollen manufacture, 390. Industry. Notes upon it, 288. Joynt-stock, proper for Barbary and why, ib. Joynt-stock to India, its conveniencies, and contrary. No reason it should lessen trade, 181. Iron. What. How much imported in 1694. A catalogue,

INDEX.

logue, 267. Divers oars, 268, and Irons. Due temper for Iron. How to harden it. Varieties in iron-work, 269. Earths over iron-stone signs of good oar. Names of oars. Different sorts. A sweet liquor in iron-stone, what thought to be, 270. Different irons, with their description and use. How they run iron, 271. How they cast sows and piggs. How to make the furnace without the ill conveniences, 272. How sows and piggs are prepared for bars and drawn into such, cut and fagotted. A note of late improvement, 273. Cast-iron used for rolls. 'Tis very brittle. Lapis hæmatites an iron oar, and why so thought. The manner of hardening iron, 274. Tough and brittle hardening. Steel, how made now and formerly, 275. Annealing of iron. Softning with fat things. 2000. Nail-makers in Sedgely. Extraordinary locks, 276. Curiosity of lock-work, spur-work and bridle-work, 277. Variety of stirrups, saddle-work, buckles, pots. The manner of tinning iron-ware, and to prevent rust. Curious iron-works, 278. Iron, its composition. It vitrifies and helps to make enamels. Steel-making. Its nature. Iron, preferable in medicine. The best crocus-martis. A guess at the cause of burning-mountains. Earth-quakes, hurricanes, pillars of water, thunder-bolts, lightnings, rains, after-thunders, and mineral-waters. Steel-medicines, their character, 278

K.

KELP. *Where the best, 199. Kelp. Its description. How much ashes imported. What 'tis, and its use, 336.*

L.

LAPIS calaminaris. *Its use; how much imported in 1694. 201.*

Lapis hæmatites will apply to the magnet, 274. It cures beasts that make bloody water with constant success, ib.

Lead, its description. Sorts in Gresham-college, Its weight in air and water. 'Tis heaviest unmelted. Its comparative weight, 262. Staffordshire lead. Difference of oars. How separated from the Stone. Less lead where more coal used for many things. It may be purged, calcin'd. Salt of lead and sugar, &c. It

K k 4

turns

I N D E X.

turns to glass, and dissolves sand. Bullet and shot made of it. Difference in weight between large and small shot. Bullets hollow and lighter than shot. To make shot fly close, 263. How shot is made, 264. How to make cerufs, 265. How lead purifies gold and silver, and litharge is made. Lead calcin'd. How minium and plumbum ustum is made. Why these are mixed with ointments and emplasters. Calcin'd lead encreases in weight. A reason. It may be reduc'd to lead again. Mill'd lead, 266.
League, a tripple one between England, Scotland and Ireland better than all other, 178.

M.

MADDER. *How much imported, 1694-5. Its description, use. It delights in our climate. Its culture. How us'd in dying, two sorts. It dyes Bow-dye. Increases the stuff one in twelve, 337. Five sorts. The price. To what value imported. Planted near Wisbich. Its planting here will employ many, 338.*

Manufactures. Its increase here will increase importations and our naval strength; this illustrated, 200.

Marbles, knickers, stone-pots, bottles, melting-pots, and retorts. How many imported. A proposal, 189.

Mercury got from cinnabar; of which divers sorts are in Gresham-college. Best vermilion. Silver refin'd with mercury. How brass is gilded and looking-glasses silver'd. Best and worst paint. Medicinal uses of quicksilver. It devours Metals. How to know the best and purge it, 280. Mercury-mines of Friuli, how deep descended and propt. The mineral as hard as stone, and more weighty also in soft earth. How mercury is gotten, 281. Virgin-mercury. How water is pumped. Labourers wages. Diseases they are subject to. Mercury gets into mens bodies. Much wood is used. How 'tis carried down. The Emperor's charge, and quantity of mercury. Number of persons working, 283. Mercury globular, therefore fluid. The cause of gravity, 284. How cinnabar is made, its proportions. What quick-silver is good for, 285. Mercury globular and volatile. The nature of globes. How mercury operates, 286. Sublimate, how made and

INDEX.

and counterfeited. Red, yellow and white precipitates. *How these will alter colour.* Sublimate stronger than arsenick. *How mercury may be reviv'd,* 287. *How much imported* 1695, 288.

Metal, *what,* 243.

Money, *The reason of its names,* 218. *Raising its denomination of no use, and why,* 250.

Mules, *their use,* 184.

N.

NATURE, *her supposed principles. Who know her most, pretend least,* 336.

Navigation, *its advantage,* 190.

Necessity the mother of invention, 335.

Norwich, *industrious.* 197.

Nuremburgh, *industrious,* *ibid.*

O.

OKRE, *Its description and reason for its name,* 238. *Ten earths over okre. Two sorts of okre. How some is managed. Where okre is found. Divers sorts,* *ib.*

Onions, *their description. What and how much seed imported, and from whence,* 322.

P.

PAIN, *its cause,* 206.

Pantiles, *how many imported,* 188.

Paper. *Its history, painted, cut, past-board, playing-cards,* 356. *Paper made from any thing of flax and hemp. Rags collected at London yearly, their price. Linsey-woolsey. How rags are washed, fermented, cut, beaten. The mortars described, and how supplied,* 357. *First stuffs, bins. How pap is managed, iron moulds, second-stuff, trial of its preparation, pit-mortar, priming the fat, the mould. How dip'd for a sheet of paper. A post what,* 358. *A farther account. Sizing,* 359. *A farther account. Made of divers things. Marbling, making of liquor and colours,* 360. *How to preserve gall. Marbling, to make the figures like serpents,* 361. *A farther account of marbling. Printing of paper-hanging,* 362. *Age of printing. Dr. Wallis's account. When it began at Oxford,* 363. *First printing on paper there. When printing began at London. Officers belonging to printing. A master printer's office,* 364. *A farther account.*

INDEX.

- account. *Names of types, or printing letters, 365. A farther account, 366. A farther account. A catalogue of compositor's furniture, 367. Manner of making Dutch varnish, 368.*
- Pellitory of Spain, *its use, 383.*
- People. *They thrive best that have occasion for most people, 319.*
- Petre, *what it is, 221. Dr. Willis's opinion about it, 222. Parts of petre, and reason of their separation, ib. A book about petre, 223. An account of it. The names, definition, analysis and generation of petre. It's thought the cause of meteors, lightning and thunder. Its use to animals and vegetables. Its extraction and refining. Its virtues and uses. Why it burns not in making lapis prunellæ. Its use in chymistry and artillery. Its mechanical use. Its use in cookery. Our petre and that of the ancients the same. Chrystals thereof found in Africa and India. Roch-petre from arched cellars. The air thought full. 'Tis extracted from rain and dew. Where chiefly found. Petre from earth laid on brick or boards will not be rich. What places will have petre. How to find it. How deep it lies. How to encrease or destroy it, ib. Making it as now a modern invention, 224. How made. The raw liquor and its colour. To know its richness. When boyl'd enough, 225. How much 100 weight of liquor yields. How to manage the ashes the 2d boyling, which will produce some common salt. When boyl'd enough, 100 weight will yield 70 lb. ib. How it shoots, 226. No petre without good management. To refine petre. How to make scum rise. How to make rock-petre. Its form, ib. A curious experiment, 227. A supposition about salt of vegetables and animals. A salt from petre like salt of urine. All volatile salts alike, ib. Dr. Hook's thoughts of petre, 230. His proof that petre is in the air, ib. Medicines from petre, ib. How much brought to London 1694, ib.*
- Pin-making, *259.*
- Plants. *Their division, 290. Imperfectly describ'd. Mushrooms, how many imported 1694. Variety of sorts. Their use, 291. Description of aquatick and gramineous frumentaceous herbs. Wheat how much imported*

I N D E X.

ported 1694. 292. Encouragement for importation and exportation. Dearness of corn an advantage. The king's interest to pay for exporting corn. Advantages of selling corn by weight, 293. Account of wheat. Granaries, their form, 294. Rye describ'd. How it grows. The best way to keep it. Its farther history, and quantity imported 1694. 295. Barley its description. Where it delights. Ratheripe. Patney ripe in 9 or 10 weeks. All turns so at Patney and returns in few years in other places. Its conveniencies. Six ears on one stalk. When ripe, and how managed, 296. Like wheat. Transmutation of corn. Advantage of barley. History of malt, 297. How dried. A brisk kiln, how turn'd. How the kiln is made. Its advantages. Floors made with plaister. How malt is trod. Brick and stone-kilns for malt. Uses of malt, Beer and ale, 398. What excise they paid in 9 years, 299. How much malt at once in Ware. How many barges, and what they carry. Some brought by land, and why, 300. Oats, their history, 304. Flummery. Oats useful in Scotland. Oatmeal-bread. Oats grow in most countries. Useful for most creatures. Best way to keep them. Red oats. Naked oats, 305. How many imported 1694. Rice, its description. Quantity imported. Uses, 306. Canes. How many imported. Their uses. Cane-chairs preferr'd, 307, 308. Sugar cane: vide sugar.

Poison, its definition and different sorts, effects and antidotes. Contagious. Diseases thought from hence, 287.

Polymountain, its uses, 283.

Ponds, how to make, 236.

Poor how to employ, 389.

Poor care for them, 299.

Potato, its description, 386.

R.

RATS. How to kill them.

Rhaharb describ'd. How much imported. Its use. From whence brought. Planted here, 340.

Rice in Carolina, 382.

Rivers. Difference of land and water carriage. Objections and answers about navigable rivers, 300, 301.

Proposals, 301, 302. Charge of making rivers navigable,

I N D E X.

- vigable, and conveniency. Objections and answers. Conclusion, 303.*
- Roads, *how to mend, 219.*
- Roads, *well mended in Oxford-shire, Hertford-shire, Deptford and Holland, 193. At White-chappel and White-hall, 194. Charities towards mending them, ibid.*
- A Road-master should be a good beggar and mathematician, 191.*
- Roads, *Roman and the conquerours, how made, ib.*
- Ros-solis *its description, vertues and vices. How much imported, 223.*
- Russia. *What commodities come thence, 382.*

S.

- S**AFFRON, *its description, 321. Its culture use, place of growth and abuse, how much imported, whether best to prohibit or heighten the duty, ib.*
- Salt, *how much imported, 1694. How many ships it would employ. A guess at the quantity spent, and ships it might employ. Advantages of making our own salt, 209. Different sorts, description of salt. It and sal gem the same. Salt ferments with oyl of vitriol. Conjectures about the saltiness of the sea, 210. Sea-water three in a hundred salt. Excellent salt at Preston Stafford-shire. Difference of brines at the witches. How long watery part is evaporating. The bigness of pans. How much coal spent to a drawing. Sand in brine. How much. How clarified. How salt is corned, 211. The draught of salt. Clarified with whites of eggs. Bloud gives an ill colour and savour. Stafford-shire salt more cleared from sand than Cheshire, or Worcester-shire. Several brines in Stafford-shire. Crag's account. In Spain, Portugal and France, 'tis made by the sun. The French greatly make salt upon salt. Scotch and English made by boyling, and best care makes best salt. How salt upon salt is made, 212. Port-sea salt commended. How much salt vended yearly to Northern kingdoms. Where the chief brine-pits. Qualities of best salt. Northwich best situated. What boyling required to make salt, 213. An estimate of Strength of brine, by the coals spent. Number of pans at the witches, quantity of salt made, and coals spent there, with the cost of every*

I N D E X.

every thing. The springs are from rocks. More salt may be made in England, than can be spent in the king's dominions. Proportion of salt in sea-water and Cheshire-brine. How salt boyl'd at Nampt-wich, and in what time. How clarified, and why. Accidental differences. At Up-wich the fourth part of the spring salt. Dimensions of leaden-pans. Rosin, its use in salt-works, 214. How to raise scum in brine-pans. Salt-springs cool, and never freeze. Salt will dry quickly. Its weight. Why some seasons sooner than others. White salt makes best colour. Clod-salt. Its use. Salt-loaves will keep. How salt came to be made at Shields. Their pans described. How filled and boyled. Salt may be plentiful there, for 'tis improved. Difference in salts. Newcastle salt good for most purposes. Salt upon sand. In Varro's time no salt &c. on the Rhine, 215.

Salt, where had easily, 217. Beef, how salted at Smirna at Midsummer, *ib.* Affirmations about salt, with notes, *ib.* Many places yield sun-made salt, 218. Cape Verd Island describ'd, and manner of making Salt there and at Limmington, *ib.* Ground for salt-works describ'd, *ib.* Best situation for salt-work, 219. Where salt-works to be wish'd for, *ib.* Salt, had we enough, 'twould be a great advantage, 220. Salt fertilizes, *ib.* Brine prevents smut, *ib.* Salt of dung differs from fossile and marine, *ib.* Articles of Dutch-salt, *ib.* How much foreign salt we spend, *ib.* Portsea salt commended. Weight of several salts, *ib.* How much made and imported in a year, 221. Quarries for improving the trade, *ib.*

Scamony described. Its use, 383.

Sea-sand that's good for land, is most shells, 220.

Sea turns to stone, 226.

Ships. The number that came from all principalities to London, anno 1694, 169. From Spain, Canaries and Flanders 148 ships, 175. From Germany 145. 176. From West-Indies 188. 177. In anno 1660, 50 Sail from Virginia and Maryland, 177. 66 Ships came from Scotland in 1694. 178. From Streights came 21 ships, 179. From Dantzick came 21 ships. From Holstein 16. From Ireland 8. 179. From Guernsey and Jersey 8 ships. From France 7 ships, 180. From India 4 ships,

INDEX.

- 4 ships, and to Holland 15 or 16. ib. From Russia came 4 ships. 182. From Guinea came 3 ships. ib. From Barbary came 2 ships, 186. Its contents, ib.
- Silver, what. How much imported 1694. From Spain the great proportions, its uses and reason of its plenty. Non-exportation of little use. A proposal for its increase, 246. Divers oars, 247. Erckern's account of its working. Silver in England, Scotland and Ireland. Silver coin, 248. Its deficiency and mending, ib. How got from copper, 261. How much brought to all the mints, 287.
- Society-royal, the advantage of it, 382.
- Spring offensive purify'd by salt, 220.
- Spurry described. Its use. Three sorts. A proposal, 339.
- Stock-jobbing, its advantage, 196.
- Stones. Slate, 194.
- Stones, 6 sorts. A list of vulgar stones, 188. How much imported under name of stone, 190. Ragstone, what, paving-stone and pebbles, how much imported, ib.
- Sugar-cane, its description. What makes sugar kern. How refined and sugar-candy made. That of the ancients not the same with ours, 308. Its history in Barbadoes. When first. How improved. The particulars, 309, 310. Where to set the ingenio, and why. How planted formerly, 310. Manner of planting and weeding them. A supply, 311. Sugar-cane described. Part food for cattle. How carried home, and where laid. How long they will keep good after cutting. How pressed, 312. The liquor will soure in a day, and it must before it be distilled. How it boils and kerns. Oils used. How long the work holds without ceasing. In what cooled, and how the goodness is tried, 313. Peneles, how made. How long Muscavado is in curing. An invention. What are ill canes. How sugar is taken from the pots and sent to Bridge-town. The best and worst Muscavado, 314. White sugar, how made. To prevent mischief. Distilling of skimmings. Strong spirits must be taken care of. A sad accident. To prevent the like. Use of spirits, 315. How much sugar an acre will bear. What the island is supposed to produce, 316. How much

I N D E X.

much imported 1694. *Notes on it. A proposal*, 317.
Conserves, preserves and candies, what. The charge
of divers things, 318.
 Sulphur, *Dr. Willis's proof of it*, 222.
 Sulphur describ'd, 237. *Divers in Gresham-college and*
in Coal-mines. A cause of Earthquakes are thought Sul-
phureous waters, *ib.*
 Sweat, *its cause*, 206.

T.

THIMBLE-making, 260.
 Tin, *what. When first found in Germany. Tin*
in Devon. Stannary-laws where tin is coined. Post
coinage. Stannaries jurisdiction restrained. Stan-
nators consent to laws, 250. *Tin mines in few places*
except Germany, and England. English the best.
Some gold in it. How much made yearly. Tin-stone
describ'd. Tin, the lightest of metals. How to manage
tin-stone. Divers sorts of tin, 251. *More tin oar.*
Uses of tin, particularly in tinning metals, 252, 253.
How many tin-plates imported 1694. A proposal for
tinning them here, 253. *Tinners complaints. Price of*
it in old time. Coining it at the blowing house thought
an advantage. Tinners diet. Pewter, how made.
How first used for grain colours, 254.
 Tobacco describ'd. *How much imported anno 1694-5.*
Its custom, 383. *Exported, what profit to the crown.*
K. James I. his book. Six pence the pound custom. How
much it may amount to, 384. *We do not spend three*
quarters of a pound the head per annum. Tobacco
improves other trades. Its use, culture and cure. How
to make it mild. 'Tis sent to Muscovy. Whether best
to plant it here or not, *ib.*
 Toothonaag, 251.
 Trade, *remarks on it*, 267.
 Trade. *An objection and answer*, 200.
 Trade foreign being bad, *cause of the badness among*
clothiers and weavers, 231. *A supposition. Great pro-*
fit by Indian trade in divers respects, *ib.* *The Com-*
pany's interest to carry out goods, 232. *They do like*
complainers. To give money for Indian goods will
enrich us. No more men in probability lost by voy-
ages to the East than West-Indies. If otherwise, 'tis
worth while, *ib.*

Tu-

INDEX

Tuberoſe. Its deſcription and uſe. How much imported. A propoſal, 323.

V.

VINE, *its deſcription. Quantities imported, alſo of brandy, cremor tartar, argol, vinegar and rape anno 1694-5. 387. A gallon of wine a head ſpent in a year in England, 388. 'Tis a good trade, and will much encrease our ſtrength, ib. Wine paid for with money hurts us not, 389. A ſwap hurts us not, ib. We give nothing but product for wine, and money, if wanted, will come into a trading nation as faſt as 'tis carried out, 289. Hiſtory of wines, 391 to 395.*

Vitriol, its deſcription, 223. How much imported in one year, notes on it. Of what made. What ſorts of copperas in Greſham-college, ib. Copperas-ſtones where found and beſt, 234. Their differences. Several things found in them. What uſes put to. How beds are made to hold copperas-ſtones. How copperas is made. The ſtones are 6 years preparing. What ripens them and what retards. Stones will ferment. How often the bed is reſreſh'd, and in what manner. A ciſtern of 700 tun, ib. Tryal of copperas-water, 235. The liquor will ferment and burn. How boyling is managed with iron. 1500 Weight to a boyling. When boyled enough. A caution, ib. A deſcription of the cooler and the copperas, 236. Copperas-water good for ſore eyes. Copperas boils beſt with iron, ib.

Vitriol, ſulphur and alom, their nature, 238. Vitriol and alom made from common Salt, ib.

W.

WATER, *rain and other differ, 236. A miſtake, ib. Brakiſh waters beſt for long voyages, 220.*

Water, how it riſes in a pump, 284.

Wealth and expence of Romans, 245.

Wealth. Some notes for its encrease, 306. Examples, 316.

Wealth. Advice about it, 200.

Whet-ſtone, 194. Dog-ſtone, 195. Middle prized ſtone. A catalogue, alabaſter, marble, agat, chryſtal, ibid.

Weld or woad, its deſcription, hiſtory and culture, 381. how much imported 1694-5. ib.

Wood, a tax on it uſeful, 242. Its deſtruction wiſhed for, 288.

Wood-land, its full improvement, 214.

Wool, plentiful, yet dear, 390.

The end of the SECOND VOLUME.



M
N
E